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Canada

FORESTRY in the ATLANTIC PROVINCES

ATLANTIC DEVELOPMENT BOARD

FORESTRY

in the

ATLANTIC PROVINCES

Cat. No.: TD2-1/1

FOREWORD

This report is the first of a series initiated by the Atlantic Development Board to examine important aspects of the economy of the Atlantic Region. It was prepared as a background document for public discussion of regional development policies.

The Atlantic Development Board Act authorizes the Board to prepare "... an overall co-ordinated plan for the promotion of the economic growth of the Atlantic Region." The various studies that the Board has prepared provide the basic facts on which development policies will be formulated. They are being published to contribute to public understanding and discussion of the major policy issues in the economic development of the Atlantic provinces.

Historically, the forest resource has played a dominant role in the economic life of the Atlantic Region. The pendulum has swung from, at one extreme, impatience with the forest cover as an impediment to agricultural development to, at the other, heavy exploitation of the cream of the forest crop for the production of wooden ships. Timbers and lumber have long been exported. More recently the forests have provided the base for a growing pulp and paper industry. Now and for the foreseeable future, it seems certain, the forests will continue to be of particular importance in regional economic development.

This report attempts to assess the state of the forest resource in the Atlantic Region and the respective provinces and to examine some of the factors which will determine the potential development of forest industries over the next decade. It is not a plan for development; it is, rather, a compilation of information - some new, some well known - viewed comprehensively for the first time.

The report draws heavily on studies, commissioned and financed by the Atlantic Development Board, which were prepared by Dr. J.W. Ker and the staff of the Atlantic Forestry Institute in Fredericton. A supplementary study was undertaken by Prof. L.R. Seheult on woods operations and transportation. Forestry research being carried out in the region was summarized by Dr. I.C.M. Place, Fredericton, and Dr. W.J. Carroll, St. John's, both of the Canada Department of Forestry and Rural Development. The report was prepared by A.D. Crerar of the Atlantic Development Board staff, with the editorial assistance of J.F. Kinzel.

A federal-provincial advisory group gave generously of its time at critical stages of data collection and report preparation. Members included:

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R.H. Burgess, Deputy Minister, Nova Scotia Department of Lands and Forests, Halifax;

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Their participation in an advisory capacity, of course, does not imply any measure of responsibility for the report or its findings.

Part One of the report examines the region as a whole - the nature and extent of the resource base and its potential for expansion to 1975; the marketing outlook for pulp, paper and lumber; the emerging technological changes and their anticipated impact; and the problems of transporting wood from forest to mill.

Parts Two through Five consider in more detail the forest resource and the distribution of forest products industries in each of the provinces. Institutional arrangements are briefly examined, major problems are identified and some tentative conclusions stated.

Forestry research is reviewed in an Appendix to the report.

A series of maps, illustrating the distribution of forested land and other information referred to in the text, is bound between Parts One and Two.

CONTENTS

MAPS

(Bound between Parts One and Two)

FORESTRY in the ATLANTIC PROVINCES

PART ONE

A REGIONAL SUMMARY

PART ONE
CONTENTS

PART ONE
TABLES

PART ONE
TABLES

PART ONE
TABLES

Page

PART ONE
TABLES

FIGURES

PART ONE
FIGURES

FORESTRY IN THE ATLANTIC PROVINCES

PART ONE: A REGIONAL SUMMARY

1. THE RESOURCE BASE

The limitations governing the potential yield of the forests in the Atlantic Provinces lie not so much in the physical capacity of the soil and the natural environment as they do in man's ability and willingness to manage the forests more intensively. It is a problem, not only of forest management, but of social management: social values attached to the resource; social attitudes toward private versus public control of the resource; institutional arrangements governing ownership of the resource - all affect the level of forest management which can be achieved.

Social values, attitudes and institutional arrangements in the Atlantic Provinces (as elsewhere in North America) have retarded the development of effective forest management. Historically, the resource appeared limitless. This, coupled with deeply held convictions about the absolute control vested in private owners of land, has tended to place conservation low in the scale of social and economic values. Governments have been timid in asserting their responsibility - even with respect to publicly owned forests, and they have exerted very little authority over the management of private forest lands.

Among Canadian provinces, only Ontario, Alberta and British Columbia have faced up to the need for regulatory measures and given them legal force. Most of these measures, although in the right direction, are essentially limited to preventing further breakdown. Some tentative steps have been taken in the Atlantic Region, but only Newfoundland has indicated clearly its management intentions: to grow timber on an 80-year rotation for the pulp and paper industry, relegating sawtimber demand and production to a secondary position. Newfoundland has yet to translate this decision into a management program.

In the following assessment of the forest potential in the Atlantic Provinces, no early solution to these problems is assumed. We are concerned here with the levels of output which can be achieved given the present condition of the forests, forest management plans which would continue present practices and regulate cut to achieve a sustained yield, and the existing social climate. Note is taken of some improvements which could be realized through more intensive management or altered tenure arrangements, but these are not quantified.

Foresters must think in terms of 80 to 100 years or more. It is highly presumptuous to project levels of output for such a long period in the future; particularly in a time of rapid technological change, any such projection must be subject to large errors. It is also extremely difficult to foresee the level of industrial demand for wood 100 years from now. However, history supports the view that we would be wise to conserve and develop our forest resources.

The information upon which to base projections of future yields is both imperfect and uneven. The quality and quantity of inventory data, the collection and recording of industry statistics, the state of forest management practice - all vary significantly from province to province. It is therefore impossible to examine the forest resource in each province in comparable depth. For this reason the various provinces are treated somewhat differently in the sections which follow.

Forests of the Atlantic Region

In area, the forests of the Atlantic Provinces (Labrador and the Island of Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick) comprise about 7.5 per cent of Canadian forest land, productive as well as non-productive (Table 1-1). In merchantable timber, the Atlantic Provinces fare less well. Table 1-2 presents the latest D.B.S. information regarding the forest inventories and a comparison with the national inventory.

TABLE 1-1

Forest Area Classification, Atlantic Provinces and Canada, 1963

Classification	Atlantic Provinces	Canada	Atlantic Provinces as % of Canada
	----- 000 acres -----		%
Productive forest land:			
Softwood - merchantable	24,363	200,396	12.0
young growth	6,342	142,312	4.5
Mixed - merchantable	8,374	84,495	9.9
young growth	1,865	57,505	3.2
Hardwood - merchantable	1,793	32,166	5.6
young growth	801	41,138	1.9
Unclassified	3,593	56,291	6.4
Total productive forest land	47,131	614,303	7.7
Non-productive forest land	35,640	480,601	7.4
Total forest land	82,771	1,094,904	7.5

Source: Canadian Forestry Statistics, 1963 and 1964. D.B.S.

TABLE 1-2

Merchantable Timber,[1/] Atlantic Provinces and Canada, 1963

Species	Atlantic Provinces	Canada	Atlantic Provinces as % of Canada
	--- 000,000 cubic feet ---		%
Softwood	32,311	609,063	5.3
Hardwood	8,888	139,918	6.4
Total	41,199	748,981	5.5

1/ Not defined, but generally conceded to mean stands of 5 cords or more of wood per acre contained in trees 4" and over d.b.h. (diameter breast height).

Source: Canadian Forestry Statistics, 1963 and 1964. D.B.S.

It should be pointed out that the Canadian totals are heavily influenced by British Columbia volumes. Although that province accounts for only 21 per cent of the total Canadian productive forest area, it contains 50 per cent of the merchantable timber.

Relatively, the position of the Atlantic Provinces is more favourable with respect to pulpwood. The 1963 inventory figures indicate that the Atlantic Provinces possess 10 per cent of all Canadian pulpwood (Table 1-3).

TABLE 1-3

Merchantable Pulpwood,[1/] Atlantic Provinces and Canada, 1963

Species	Atlantic Provinces	Canada	Atlantic Provinces as % of Canada
	------- 000 cords ---------		%
Softwood	279,031	2,456,363	11.4
Hardwood	52,423	717,947	7.3
Total	331,454	3,174,310	10.4

1/ 4"-9" d.b.h.

Source: Canadian Forestry Statistics, 1963 and 1964. D.B.S.

As might be expected, the Atlantic Provinces are less richly endowed with timber of sawlog size (Table 1-4). It should be mentioned that the distinction between "pulpwood" and "sawtimber" is not as clear-cut as presented here; particularly, the inventory in Newfoundland is far from complete. And, of course, the end-use of the timber is not restricted in either case to pulpwood or sawtimber. In broad terms, however, the relative emphasis on each is revealed in the tables.

TABLE 1-4

Merchantable Sawtimber,[1/] Atlantic Provinces and Canada, 1963

Species	Atlantic Provinces	Canada	Atlantic Provinces as % of Canada
	--- 000,000 cubic feet ---		%
Softwood	8,594	400,272	2.1
Hardwood	4,432	78,893	5.6
Total	13,026	479,165	2.7

1/ 10" d.b.h. and over.

Source: Canadian Forestry Statistics, 1963 and 1964. D.B.S.

Forest Depletion

Table 1-5 shows forest depletion in the year 1965 in the Atlantic Provinces. The important omission from this table is forest depletion from fires, insects, diseases, storms and natural mortality. For Canada as a whole, it is estimated that losses from insects and disease are in excess of 1.0 billion cubic feet of merchantable timber annually. The average annual loss in merchantable timber burned between 1954 and 1963 was approximately 0.5 billion cubic feet. Assuming, therefore, for Canada as a whole, a loss of 1.5 billion cubic feet of merchantable wood annually, and further assuming a proportional distribution of losses, the Atlantic Provinces annually lose some 80 million cubic feet of timber from these causes.

Total forest depletion therefore approaches 500 million cubic feet annually in the Atlantic Provinces. Surprising as it may be, however, current levels of depletion in all four provinces are essentially the same as they were 20, 30, 40 or 50 years ago. In fact, at present, the annual harvest is less than it was 20 years ago. This is caused partly by more complete utilization of primary forest products and partly by smaller losses through some progress toward integrated forest operations. Also a factor is the drastic decline in lumber production, which has not yet been balanced by an increase in pulpwood production. Only for Newfoundland is it estimated that annual forest depletion has increased steadily over the years.

The shift from sawlogs to pulpwood in the three Maritime Provinces is illustrated in Figure 1-1.

FIGURE 1-1

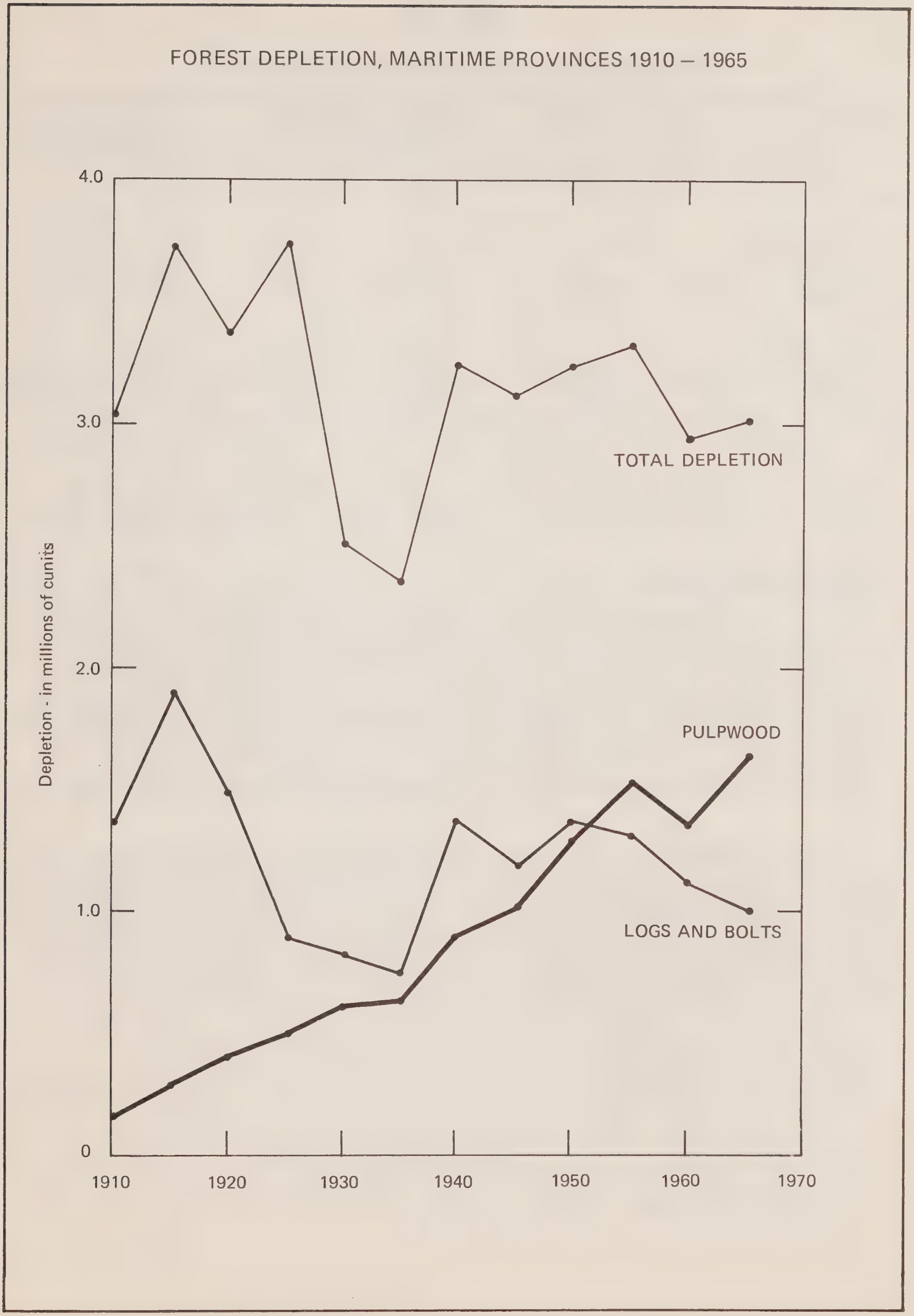
FOREST DEPLETION, MARITIME PROVINCES 1910 — 1965
4.0
3.0
2.0
1.0
0
Depletion - in millions of cunits
TOTAL DEPLETION
PULPWOOD
LOGS AND BOLTS
1910
1920
1930
1940
1950
1960
1970

TABLE 1-5

Forest Depletion, Atlantic Provinces, 1965[1/]

Province	Sawlogs & Bolts	Pulpwood	Fuelwood	Others	Total
	---------- 000 cubic feet ----------				
Nova Scotia	42,572	47,661	11,340	1,126	102,700
New Brunswick	54,810	113,960	14,872	6,150	189,792
Newfoundland	6,000	82,425	17,000	3,000	108,425
Prince Edward Island	1,500	4,900	3,000	500	9,900
Total	104,882	248,946	46,212	10,776	410,817

1/ New Brunswick and Nova Scotia figures refer to 1964-65 logging season.

Source: Provincial government publications. Estimates for Prince Edward Island and Newfoundland are based in part on personal estimates.

Age-Class Distribution

Among the more important omissions in provincial inventory data, as reported by D.B.S., is age-class distribution. This information is necessary for intelligent management of the forest resource. The usual classification of productive forest area is in terms of merchantable, young growth and unstocked areas (Table 1-6). Unfortunately, no satisfactory or uniform definition of "stocking" is given. The total area of merchantable forest in the Atlantic Provinces is 34.5 million acres; young growth occupies 9.0 million acres and the unstocked area comprises 3.6 million acres.

Although some of these statistics are questioned, they constitute the latest information available on a uniform basis. Changes from previously released figures generally reflect better inventory information, rather than actual changes in areas or volumes. A comparison with the 1956 inventory, for example, is quite meaningless. These 1963 statistics, therefore, plus whatever additional information may be available from provincial sources, must provide the starting point for projections of future yields.

TABLE 1-6

Area Classification by Province, 1963

Productive Forest Land	Newfoundland Labrador	Newfoundland Island	P.E.I.	N.S.	N.B.
	------	------	000 acres	------	------
Softwood:					
Merchantable	11,358	4,272	50	4,653	4,030
Young growth	504	3,231	253	505	1,849
Mixed wood:					
Merchantable	--	258	85	3,360	4,671
Young growth	--	172	93	293	1,307
Hardwood:					
Merchantable	--	6	8	538	1,241
Young growth	--	156	7	29	609
Unclassified 1/	1,500	215	24	273	1,581 2/
Total	13,362	8,310	520	9,651	15,288

1/ Includes areas of recent burn, cut-over, windfall, not yet restocked, essentially unstocked.

2/ Provincial authorities believe that a relatively small part of this acreage will require restocking by artificial means.

Source: Canadian Forestry Statistics, 1963 and 1964. D.B.S.

The upper limit of young growth may be set, admittedly arbitrarily, at 40 years. Considering that the optimum rotation ages of spruce and balsam fir, the predominant species in the Atlantic Provinces, are around 80 and 60 years respectively, it would be expected that young growth occupies about half the productive forest area. Ideally, few unstocked areas should exist, since restocking should occur immediately following or soon after a cut or burn. Actually, this does not always happen, and allowance should be made for a certain amount of burnt-over land, windfall and other catastrophes which might cause a site to be unstocked. If we assume that it takes 4 years for a stand to be re-established, and further assuming an 80-year rotation, then the proportion of forest area unstocked should be 5 per cent. Merchantable forest should constitute 50 per cent, and young growth 45 per cent, of the productive forest area. A cursory glance at the table shows that this is not the case - either for the entire Atlantic region, or for any of the provinces. The present distribution, as a proportion of productive forest land, is presented in Table 1-7.

TABLE 1-7

Merchantable, Young Growth and Unstocked Areas, Atlantic Provinces

Size Class	Newfoundland Labrador	Newfoundland Island	P.E.I.	N.S.	N.B.	Atlantic Provinces
	----- % of productive forests -----					
Merchantable	85	54	27	88	65	73
Young growth	4	43	68	9	25	19
Unstocked	11	3	5	3	10 1/	8 2/
Total	100	100	100	100	100	100

1/ See footnote 2, Table 1-6.

2/ If Labrador is excluded, the percentage of productive forest area unstocked averages 6 per cent.

Source: Table 1-6.

Collectively, the provinces do not approach the age-class distribution suggested above. Of the individual provinces, only the Island of Newfoundland appears to have a good distribution.1/ In some cases, unstocked areas are too large. Also, there appears to be an overabundance of merchantable forests, and not enough young growth to take the place of merchantable forests as they are logged. This situation should gradually be overcome as forests are cut over. Nevertheless, overabundance of merchantable stands will inevitably lead to over-mature stands, susceptible to insect attacks, unsalvageable mortality and other losses.

In the sections which follow, provinces are examined individually. Where available, information concerning depletion, incremental growth, age-class distribution and other pertinent factors is evaluated, some forest management approaches are examined and estimates of sustained annual yield of industrial wood are made. The concluding section summarizes the provincial estimates.

Nova Scotia

Nova Scotia's 1958 forest inventory was reviewed by the provincial government (softwoods only) in 1964. Table 1-8 incorporates the results of that re-evaluation. It is estimated that the gross merchantable volume in 1958 included 6.5 billion cubic feet of softwood species and 3.2 billion cubic feet of hardwood, for a total of 9.7 billion cubic feet.

1/ This may be more appearance than reality. There is no agreement on the extent of unstocked areas in Newfoundland; some estimates range as high as 2 million acres.

TABLE 1-8

Estimated Merchantable Timber Volume, Nova Scotia, 1958

Species	Volume		
	Gross Merchantable	Sawlogs 1/	Pulpwood
	------------- 000,000 cubic feet -----------		
Softwood	6,454	2,784	3,487
Hardwood	3,233	388	2,561
Total	9,687	3,172	6,048

1/ In Nova Scotia the lower d.b.h. limit for softwood sawlogs is set at 7.6", compared with 9.6" in New Brunswick.

Source: Hawboldt, L.S., and R.M. Bulmer. The Forest Resources of Nova Scotia. Nova Scotia Dept. of Lands and Forests, 1958; Revised estimates, 1964.

The area of merchantable forest in 1963 was just over 8.5 million acres, out of a total productive area of about 9.7 million acres (Table 1-9).

TABLE 1-9

Forested Land Classification, Nova Scotia, 1963

Classification	Area
	000 acres
Productive	9,651
Merchantable	8,551
Young Growth	827
Unstocked	273
Non-Productive	764
Total Forested Land	10,415

Source: Canadian Forestry Statistics, 1963 and 1964. D.B.S.

Although no estimates of volume depletion by fire are available, areas burned have become smaller over time, a sign of improved forest protection (Table 1-10). The re-burning of barrens and old burns, however, tends to render these lands permanently unproductive. Much of the non-productive land listed in Table 1-9 is in this category. The timber most seriously affected by fire is young growth; timber in merchantable forests is salvaged whenever possible.

TABLE 1-10

Forested Lands Burned Per Decade, Nova Scotia, 1916-1965

Period	Merchantable	Cut-Over	Young Growth	Barren, Old Burn	Total
	----------	----------	000 acres	----------	----------
1916-1925 1/	--	--	--	--	265
1926-1935 1/	--	--	--	--	217
1936-1945	11	10	47	41	110
1946-1955	12	27	32	50	120
1956-1965	10	5	16	43	73

1/ Available statistics include only total acreage burned.

Source: Nova Scotia Dept. of Lands and Forests, Annual Reports.

Age-Class Distribution

More data on age-class distribution are available in Nova Scotia than in other Atlantic Provinces. The 1958 forest inventory gives an estimate of age-class distribution. Although by its nature it is not a completely valid estimate of "distribution of forest stands by age classes" (as its title states) it provides some indication (Table 1-11).

Perhaps a better estimate of age-class distribution is contained in a 1966 company report which covers an estimated 5.6 per cent of the province's productive forest area and 6.1 per cent of the volume (Table 1-12). Although not a valid sample of the total forested area, it is judged to be more representative of the current situation than the 1955 estimate. The discrepancies between the two are revealed by comparing columns 3 and 4 of Table 1-12. For the important age classes there is little agreement between the two estimates.

Depending on the species, over-maturity is not as severe a problem as might appear from the table. Red spruce, white pine and hemlock mature between 120 and 200 years. Many hardwoods (particularly the more valuable) mature between 100 and 200 years. However, the pulpwood species, principally the balsam fir and white spruce, are short-lived, and for these, rotations of less than 100 years are appropriate. Balsam fir matures at about 60 years. The pulpwood species are, economically, the most important species.

The total area supporting forest stands over 120 years is estimated to be 627,000 acres (see Table 1-12). This is fairly close to the hardwood acreage (567,000) estimated in the 1958 forest inventory. Because hardwoods are relatively underutilized, it is reasonable to assume that hardwood acreage has increased in the 10-year interval. On the basis of this rough indicator, 627,000 acres would seem to be a not unreasonable estimate of the area of over-mature forests.

TABLE 1-11

Distribution of Forest Stands by Age Classes, Nova Scotia, 1955

Age Class 1/	Distribution 2/	
years	%	000 acres
0-25	-	1,100
30	6.3	539
40	15.7	1,343
50	18.8	1,599
60	18.9	1,608
70	15.4	1,317
80	10.2	872
90	6.2	530
100	3.1	265
110	2.0	170
120	1.4	120
126+	2.2	188
Total	100.2 2/	9,651 3/

1/ Mid-point of 10-year interval; e.g., age class "30" = "26-35".
2/ Percentages assumed to apply to 8.55 million acres of merchantable forests. Percentages to not add to 100 due to rounding.
3/ Total productive forest area of 9.7 million acres includes 827,000 acres of young growth and 273,000 acres of unstocked forest land, all of which is assumed to be in the 0-25 age class.

Source: Derived from Hawboldt and Bulmer, op. cit.

TABLE 1-12

Age-Class Distribution by Area, Nova Scotia, 1965

Age Class	Distribution 1/		1955 Sample 2/
years	%	000 acres	000 acres
0-20	7.9	762	---
21-40	21.1	2,036	1,000
41-60	26.2	2,529	2,413
61-80	17.6	1,699	3,060
81-100	8.8	849	1,801
101-120	5.2	502	615
121-140	2.3	222	215
141-160	2.2	212	---
161+	2.0	193	---
Uneven-aged	6.7	647	---
Total	100.0	9,651	---

1/ Percentage of company stands applied to total productive forest land.
2/ Advanced to 1965; see Table 1-11.

Source: Company returns, 1966.

Yield Tables

The normal yield tables of Nova Scotia perform a useful and practical function in the determination of stand volumes and for prediction of yield. Indeed, they are an indispensable tool for the management of the forests. Essentially, they provide information on yields at various ages, under conditions of normal stocking, i.e., what is considered under present conditions a desirable standard of stocking. By no means do they indicate the best possible conditions under intensive management. But neither can it be expected that within the next 20 years management will be intensified to the extent that these yield tables will have to be reviewed. In the introduction to the tables, one is reminded of their limitations. They are valuable at this particular stage of forest management awareness, that is, at some point of transition between the ages of pure exploitation and forest management.

The normal yield tables presuppose areas normally stocked. No definition of "normally stocked" is given. But for the construction of the tables, plots have been selected which are considered adequately stocked - given existing levels of forest management - to provide maximum yields. The "normal" carrying capacity of the forest land as used in the yield tables does not contemplate (for example) a major intensification of management or adoption of more selective harvesting practices. It represents levels of stocking appropriate to maximum yields possible under existing conditions.

Figure 1-2 is based on the average site condition of the softwood stands in Nova Scotia. The shaded area represents natural unsalvageable mortality, or (under conditions of intensive management) removal by thinning. The correction for merchantable timber is for bark, tops, and trees under 3.6" d.b.h. Stands below 40 years must be considered unmerchantable. The graph is very general and presumed to represent all sites.

In Figure 1-3 a comparison is made between the yield-table values and a company estimate of volume per acre by age classes on its limits. Both are merchantable volumes. The comparison is possibly not quite fair, since the company's volume estimates include all species and are not a yield-table study, but describe more-or-less average conditions.

The average condition of all forests in Nova Scotia is a stand 60 years old. This stand would, under normal-yield-table conditions, have a volume of 1,750 cubic feet of merchantable timber per acre. The company estimate is of an average stand 60 years old, with an average volume of 1,088 cubic feet per acre. If the company sample is at all representative of the Nova Scotia conditions, it may be concluded that average stocking is 63 per cent of the yield-table values. At age classes 110 and 130, the stocking appears to be 67 per cent of the yield-table values. It is assumed here that the average stocking condition is 60 per cent of the yield tables. Consequently, the 60 per cent line has been drawn in Figure 1-3, in order to estimate from this line the possible yield of merchantable timber.

Under present conditions, then, it must be concluded that the forests are 40 per cent below normal stocking levels. If yield per acre is to be substantially increased, then one of the main aims of forest management should be to increase the growing stocks on forest lands to a level

approaching normal stocking. Another goal could be the salvage of natural mortality through more intensive management on all forest properties, although the added cost of such a program might be difficult to justify given the present volume of mature and over-mature timber.

Softwood Yield

If the age-class distribution presented in Table 1-12 may be accepted, and if the age classes 120+ are considered to belong essentially to hardwood forests, and if, furthermore, the 647,000 acres of uneven-aged forests are removed from consideration, then forest regulation and yield calculations may be concentrated on the remaining 8.4 million acres. If it also may be assumed that, within each age-class interval of 20 years, the age classes are evenly distributed, conditions exist as presented in Table 1-13. The volumes presented are based on 60 per cent of the normal-yield-table values.

If a 2-per-cent growth rate is assumed, the annual allowable cut from the 8.4 million acres supporting 5,947 million cubic feet, should be 119 million cubic feet, or 1.19 billion cubic feet per decade. However, since the forests contain too much over-mature timber, it might be desirable to increase the annual cut to, say, 130 million cubic feet, or 1.3 billion cubic feet per 10-year period. The 1965 harvest was 103 million cubic feet of all species, an estimated 10 million cubic feet of which were hardwoods. The present harvest of softwoods is therefore in the neighbourhood of 90 to 95 million cubic feet of softwood annually. With present standards of utilization and management, then, the softwood cut could be increased by about 35 to 40 million cubic feet per year[1/] to about 130 million cubic feet. This level of annual allowable cut is also arrived at by the Department of Lands and Forests. Three available estimates range between 138 and 146 million cubic feet.

It should be noted here that Hawboldt estimates the potential total yield to be 324 million cubic feet (softwoods and hardwoods). This is to be achieved by more intensive sylviculture, which is expected to raise the productivity of the soil by one site class. At a stand age of 80, this would involve a 45-per-cent increase in yield per acre. However, it would appear more logical to assume that this 45-per-cent increase would be the result of increased stocking to the level of the normal yield tables, rather than an increase in productivity. At present, however, the best estimate of yield is about 130 million cubic feet.

Forest Yield by Volume Regulation

Management plans ordinarily are valid for 10-year periods. After 10 years they are revised, owing to new inventory information, changing standards of utilization, market conditions, catastrophes or the fact that during the 10-year period it was impossible to adhere to the plans. The

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1/ The new mill at Abercrombie (Scott) will require 260,000 cords (22 million cubic feet) of softwoods annually.

FIGURE 1-2

NOVA SCOTIA YIELD TABLE FOR FORESTS, AVERAGE SITE CLASS IV AND V.

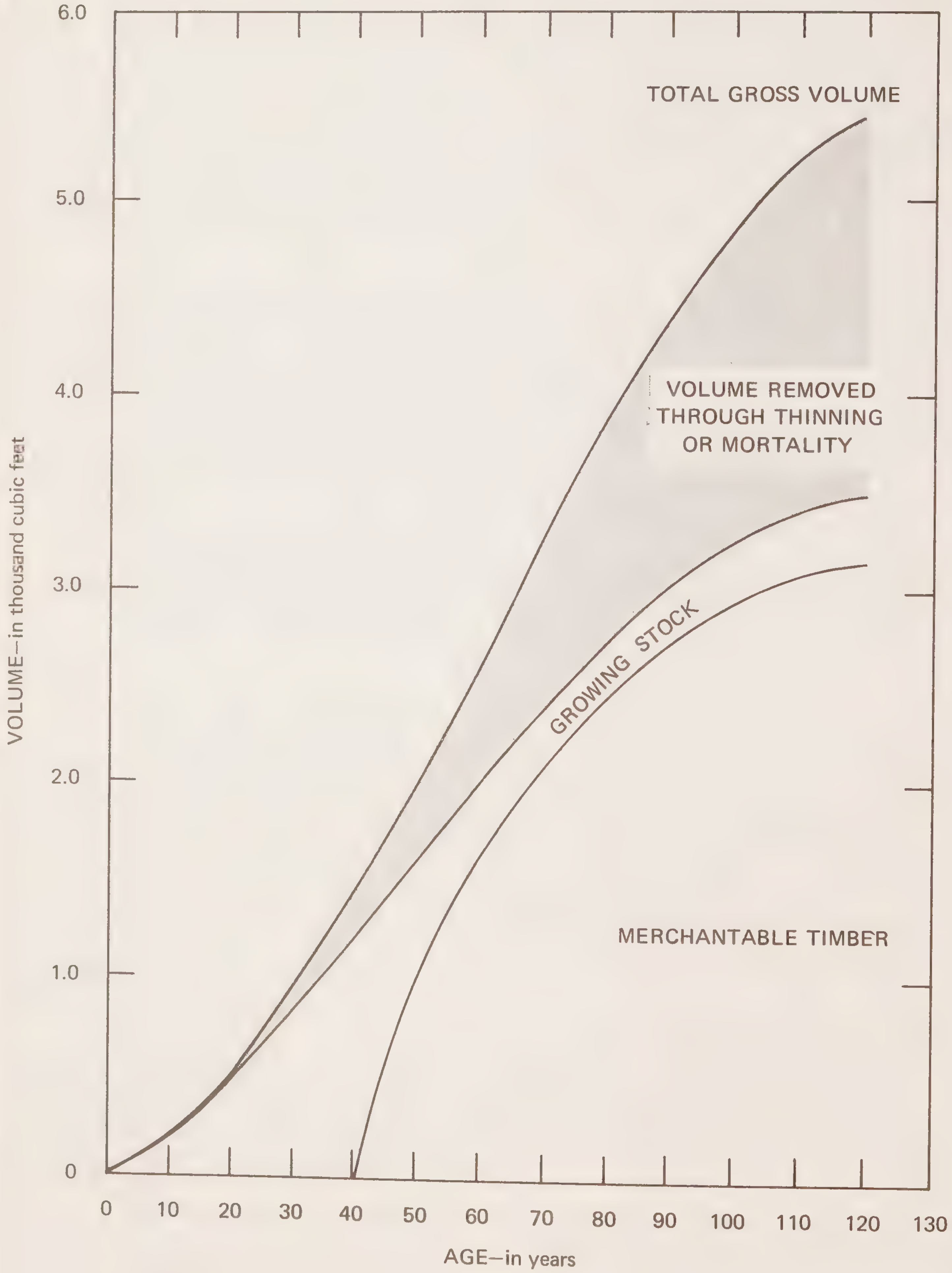


FIGURE 1-3

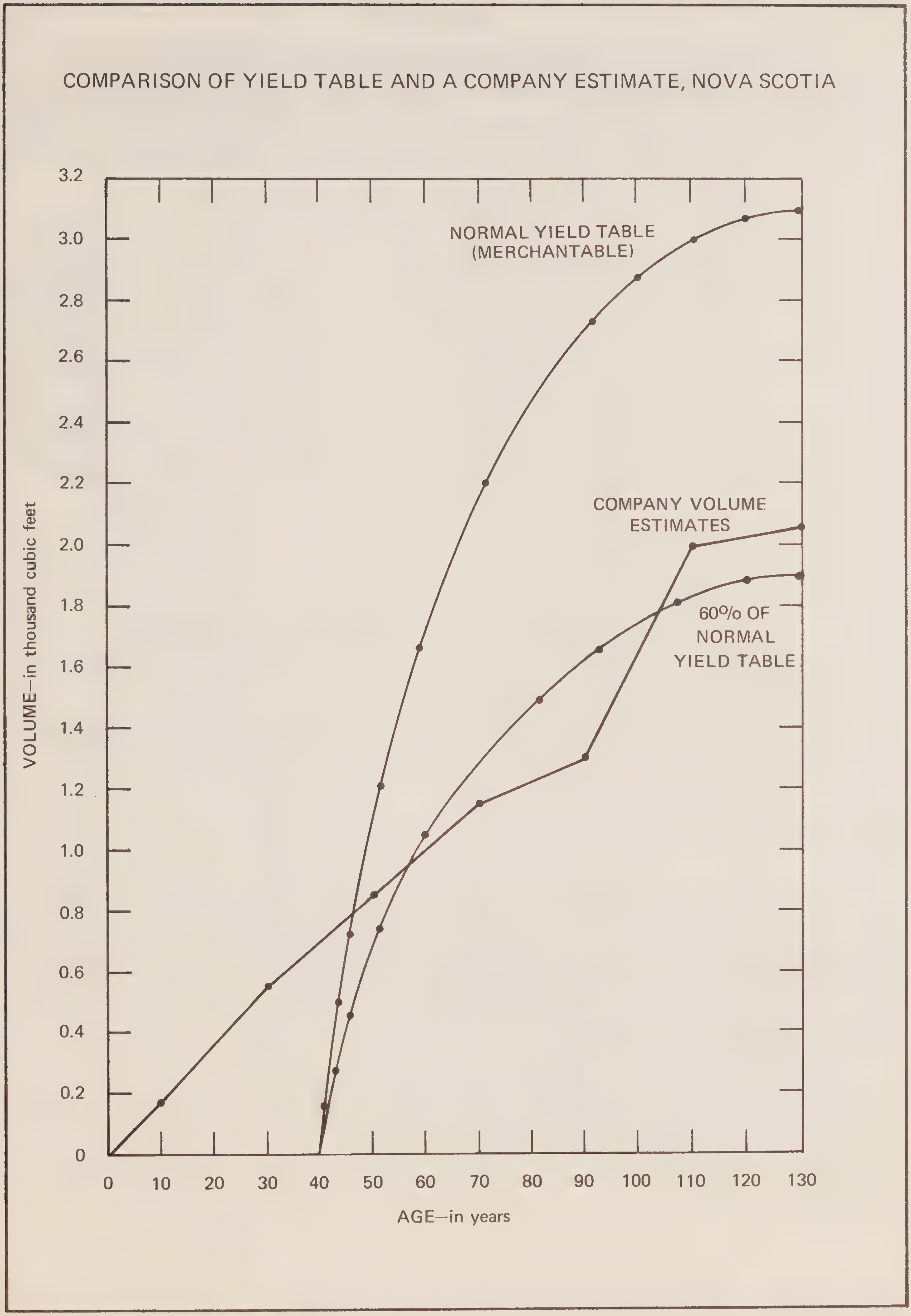

COMPARISON OF YIELD TABLE AND A COMPANY ESTIMATE, NOVA SCOTIA
NORMAL YIELD TABLE (MERCHANTABLE)
COMPANY VOLUME ESTIMATES
60% OF NORMAL YIELD TABLE
VOLUME—in thousand cubic feet
AGE—in years
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
0
10
20
30
40
50
60
70
80
90
100
110
120
130

TABLE 1-13

Estimated Forest Area and Volume, by Age Class, Nova Scotia, 1965

Age Class	Area 1/	Volume Per Acre 2/	Total Volume
years	000 acres	cu. ft.	000,000 cu. ft.
1 - 10	381	-	-
11 - 20	381	-	-
21 - 30	1,018	-	-
31 - 40	1,018	-	-
41 - 50	1,265	350	443
51 - 60	1,264	860	1,087
61 - 70	850	1,150	978
71 - 80	849	1,370	1,163
81 - 90	425	1,540	655
91 -100	424	1,680	712
101 -110	251	1,780	447
111 -120	251	1,840	462
Total	8,377	-	5,947

1/ Derived from Table 1-12.

2/ From Figure 1-2.

following table is a summary of 11 successive simulated 10-year management plans that might be adopted for the province. It is of limited value, since management on a province-wide basis does not exist. At minimum, province-wide management should comprise the sum of individual management plans of private and public forest holdings. Since even this is far from attainment, the table can only be considered an indication of the possible effect of certain assumed policies.

Table 1-14 is a summary of simulated management plans where, in each 10-year period, the oldest stands are cut and the forests depleted of 1.3 billion cubic feet of softwoods, using Table 1-13 as the basis of calculation. A growth rate of 2 per cent per year is assumed. Given this sequence of management plans the situation which might exist in 2075 is indicated in Table 1-15.

TABLE 1-14

Simulated Plan of Volume Regulation, Nova Scotia

Period	Volume of Softwoods Cut	Area Cut	Total Growing Stock at End of Period
	000,000 cu. ft.	000 acres	000,000 cu. ft.
1965-1974	1,300	694	6,497
1975-1984	1,300	706	7,071
1985-1994	1,344	800	7,287
1995-2004	1,428	850	7,098
2005-2014	1,300	834	6,861
2015-2024	1,300	746	6,771
2025-2034	1,300	731	6,717
2035-2044	1,300	728	6,723
2045-2054	1,300	712	6,795
2055-2064	1,498	814	6,684
2065-2074	1,379	762	6,675

TABLE 1-15

Simulated Area and Volume Condition, Nova Scotia, 2075

Age Class	Area	Softwood Volume Per Acre	Total Volume
years	000 acres	cu. ft.	000,000 cu. ft.
1 - 10	762	-	-
11 - 20	814	-	-
21 - 30	712	-	-
31 - 40	728	-	-
41 - 50	731	350	256
51 - 60	746	860	642
61 - 70	834	1,150	959
71 - 80	850	1,370	1,165
81 - 90	800	1,540	1,232
91 -100	706	1,680	1,186
101 -110	694	1,780	1,235
Total	8,377	-	6,675

The above tables demonstrate that it is possible to harvest a certain volume per year, without depletion of the growing stock. In fact, by cutting 1.3 billion cubic feet per 10-year period, the growing stock can be built up by about 10 per cent. Even with the plan illustrated, one is still faced with a 110-year rotation. What is likely to occur, however, is that the pulpwood species will be cut at an earlier age and the sawlogs, if suitably selected, might last to 100 years or more.

The only claim to reality underlying the tables is that the calculations show that it is possible, provided that the cutting program implied in Table 1-14 is followed, to maintain a harvest at 130 million cubic feet per year. With more intensive management, aimed at an increase of the growing stock and salvage of natural mortality, the cut could certainly be doubled. Salvage of natural mortality would increase the cut about 50 per cent, and by building the stocking to 100 per cent of the normal yield table, a further increase of 50 per cent would be possible.

Forest Yield by Area Regulation

If volume regulation is at one end of the forest-management spectrum, area regulation is at the other (Table 1-16). Theoretically, area regulation is the simplest way to regulate a forest. It will be noticed that the acreage cut every period is the same, although the harvested volumes will differ until, at the end of the 80-year rotation period, both the area and the volume of timber cut will remain stable. Assuming, within every 10-year period, that the different site conditions will be represented by the average condition, this method will result in a truly normal forest province-wide, and will reach its objective in the fastest way.

TABLE 1-16

Simulated Plan of Area Regulation, Nova Scotia

Period	Volume of Softwoods Cut	Area Cut	Total Growing Stock at End of Period
	000,000 cu. ft.	000 acres	000,000 cu. ft.
1965-1974	1,807	1,047	5,881
1975-1984	1,653	1,047	5,907
1985-1994	1,612	1,047	5,720
1995-2004	1,612	1,047	5,187
2005-2014	1,630	1,047	4,674
2015-2024	1,661	1,047	4,325
2025-2044	1,592	1,047	3,904
2045-2054	1,434	1,047	3,904

It can be seen that an 80-year rotation with area regulation will result in a rapid liquidation of over-mature stands, and depletion of the growing stock from 5,947 million cu. ft. in 1965 to 3,904 million in 2045, after which it would theoretically remain the same. On an 80-year rotation, without any intensification of forest management, it would be possible to maintain an annual cut of 143.4 million cubic feet after the first rotation. Again, Table 1-13 has been used as the basis of calculation.

In the year 2045, the situation would be as presented in Table 1-17.

Area regulation would entail a heavy cut in the beginning of the rotation of 181 million cubic feet per year from 1965 to 1974 and a gradual lowering of this level to 143 million cubic feet by the year 2045. If, however, the growing stock per acre could be brought to 100 per cent of the normal-yield-table level during the rotation, it would allow an increase of 40 per cent in the annual cut from the year 2045. This would raise the level of the annual cut to 200 million cubic feet. The growing stock, furthermore, would be increased to 5.6 billion cubic feet of softwood on 8.4 million acres, nearly the present level of 5.9 billion cubic feet.

TABLE 1-17

Simulated Area and Volume Condition, Nova Scotia, 2045

Age Class	Area	Softwood Volume Per Acre	Total Volume
years	000 acres	cu. ft.	000,000 cu. ft.
1 - 10	1,047	-	-
11 - 20	1,047	-	-
21 - 30	1,047	-	-
31 - 40	1,047	-	-
41 - 50	1,047	350	366
51 - 60	1,047	860	900
61 - 70	1,047	1,150	1,204
71 - 80	1,047	1,370	1,434
Total	8,376	-	3,904

Conclusion

The calculations of yield of softwood by volume and by area, as presented in this report, are based on a stocking of 60 per cent of the level used in the normal yield tables, as well as a series of somewhat tenuous assumptions:

a) that the age-class distribution presented in Table 1-12 is reasonably accurate;

b) that, within each age-class interval of 20 years, the age classes are evenly distributed;

c) that the estimate of 627,000 acres supporting over-mature stands of timber (mainly hardwood) is not unreasonable;

d) that the estimate of 647,000 acres of uneven-aged forests is accurate.1/

Present provincial government plans would seem to imply a policy aimed at increasing the growing stock of the existing forests to a near-normal yield-table level and a type of forest regulation that will lie somewhere between regulation by volume and regulation by area. This suggests something between a yield of 130 million cubic feet per year by volume regulation and yields under area regulation ranging from 180 million cubic feet during the earlier period to 140 million during the later period.

If the government's aim is to supply all industries with the necessary raw materials, then the accent will be more toward volume regulation, in order to supply the sawmill industry with raw material. It should be noted, however, that the industry is tending to utilize sawlogs of progressively lower diameters and lesser quality. This is a regrettable development and in the end a costly one, both to the forest owner and for the sawmill industry. Per unit of volume, it costs more to harvest small trees than big trees, although, from the point of view of regulation, it is no doubt easier to have short rotations.

Management plans must, of necessity, be flexible. Unlike agricultural crops, forest harvests can be postponed or accelerated to suit market conditions. In the long run, however, an established policy of forest regulation must be followed. To avoid depletion of growing stock, a period of overcutting must be followed by a period of undercutting.

There is no doubt that the forest yield can be much improved. The management plan of one company indicates that an accelerated harvest cut will be made to cut mature and over-mature stands. These stands will then be replaced with better stocked and more vigorous stands. This all indicates that the management aims of the provincial government are slowly being implemented. It is expected that the present growth rate of 0.25 cords per acre per year can be increased to a growth rate approaching 0.40 cords per acre per year. This is an increase in forest yield even greater than that indicated in this report.

1/ This acreage was not included in the calculations, leaving a balance of 8,377,000 acres. The stands of uneven age contain a much higher growing stock per acre than the average of the even-aged stands (2,168 cubic feet per acre against 1,012). Because of a better utilization of space, this type of forest can support a larger growing stock. It is, however, not conducive to mechanized logging and can therefore only be considered for small woodlots.

New Brunswick

New Brunswick's 1958 forest inventory estimated the total volume of softwood and hardwood stands over 4" d.b.h. to be 16.9 billion cubic feet (Table 1-18). This was comprised of 11.9 billion cubic feet of softwoods and 4.9 billion cubic feet of hardwoods. Of all species, about 40 per cent was of sawtimber size (10"+ d.b.h.).

TABLE 1-18

Standing Timber Volume by Species Group and Size Class, New Brunswick, 1958

Species Group	D.B.H. Class in Inches			Total
	4 - 5	6 - 9	10+	
	000,000 cu. ft.			
Softwood	2,225	5,423	4,299	11,947
Hardwood	686	1,583	2,652	4,921
Total	2,911	7,006	6,951	16,868

Source: New Brunswick Forest Inventory, 1958.

About 87 per cent (15.3 million acres) of New Brunswick's total land area is productive forest land. A relatively high proportion of productive forest land (10 per cent) is unstocked, but provincial officials believe that much of this unstocked area will regenerate naturally.

Depletion by Fire

Table 1-19 shows the increasing efficiency of forest protection measures and the declining role of fire in depletion of New Brunswick forests. Both in area burned and volume destroyed, losses have declined sharply and steadily in each decade since 1916.

The declining significance of depletion by fire is illustrated more precisely in Table 1-20. Forest fires as a factor in total depletion have dropped from almost 6 per cent in the 1926-1935 decade to barely 1 per cent for the period 1956-1965. This is well below the national average. Forest fire losses in Canada in the 10-year period 1952-1961 accounted for 14 per cent of total depletion by utilization and fire.1/ But New Brunswick's determined efforts to protect its forests from fire have succeeded in reducing losses to a near minimum.

1/ It should be remembered that these depletion figures do not include losses by insects and disease.

TABLE 1-19

Forest Area and Volume Destroyed by Fire by Decade, New Brunswick, 1916-1965

Period	Area Burned		Volume Destroyed
	Total	Merchantable	
	acres	acres	000 cu. ft.
1916-1925	812,365	1/	1/
1926-1935	472,357	151,117	106,430
1936-1945	261,151	205,399	49,751
1946-1955	173,949	81,879	37,346
1956-1965	138,983	66,471	18,456

1/ Not available.

Source: New Brunswick Dept. of Lands and Mines, Annual Reports.

TABLE 1-20

Depletion by Fire Relative to Total Depletion, New Brunswick, 1926-1965

Period	Depletion			Fire Loss as % of Total
	Production	Fire	Total	
	---------------- 000 cu. ft. ------------			%
1926-1935	1,765,300	106,430	1,871,730	5.7
1936-1945	1,341,261	49,751	1,391,012	3.6
1946-1955	2,172,303	37,346	2,209,649	1.7
1956-1965	1,888,780	18,456	1,907,236	1.0

Source: New Brunswick Dept. of Lands and Mines, Annual Reports; Canadian Forestry Statistics, D.B.S.

Forest Regulation

In New Brunswick there is less information than in Nova Scotia concerning age-class distribution of forest stands. New Brunswick has put more emphasis on size-class than on age-class (see Table 1-18). We are limited, therefore, to the broad classifications of "merchantable" and "young growth" (i.e., stands over and under 40 years). Estimates of the area of productive forest in young growth in New Brunswick total 3.8 million acres (see Table 1-6).

One way to get a rough check on the accuracy of these estimates is to calculate area depletion from all causes over the past 40 years. The acres of forest thus cleared should compare with the acres of young growth plus acres of forest land unclassified (i.e., essentially unstocked).

In order to estimate area depletion, certain assumptions must be made. As applied to New Brunswick, these assumptions are:

1) that the standing volume of 16.9 billion cubic feet remains constant;

2) that the entire standing volume is merchantable;

3) that the volume increment in merchantable stands is nil during any 10-year period; and

4) that harvesting is by clear-cutting.

Applying these assumptions (16.9 billion cubic feet of merchantable volume concentrated on 9.9 million acres of merchantable forest land) gives an average volume of 1,700 cubic feet per acre. Applying the volume cut in any 10-year period (under the above assumptions) then provides an estimate of area cut. By adding to this area cut the total productive forest area burned during the period, an estimate may be made of the area that becomes free during the period for stand regeneration[1] (Table 1-21).

TABLE 1-21

Estimated Area Depletion, Merchantable Forest,

New Brunswick, 1926-1965

Period	Area Cut	Area Burned	Total Area Depletion
	000 acres		
1926-1935	1,040	472	1,512
1936-1945	790	261	1,051
1946-1955	1,380	174	1,554
1956-1965	1,110	139	1,249
Total	4,320	1,046	5,366

1/ This may be inaccurate, because fire sometimes damages the soil, resulting in a long unproductive period. Soil damage is recognized as a factor by the New Brunswick Dept. of Natural Resources, and a value is attached each year to this loss.

The total forest area depleted over the past 40 years is, by this estimate, 5.37 million acres. This acreage does, in fact, compare quite closely to the total area of young growth (i.e., age classes under 40), plus the unstocked area, listed for New Brunswick in Table 1-6 (5.35 million acres).

On the basis of current cutting practices, growth rates and the diminishing loss through fire, it would seem that, if current levels of production are maintained over the next 40 years, only half of the present 9.9 million acres of merchantable forests will be cut, leaving 4 to 5 million acres in a state of over-maturity, susceptible to insect attacks. What implications does this have for forest management?

One way to deal with the temporary excess of merchantable timber would be to double the cut over the next 40 years. However, at the end of the period this would mean cutting the harvest back again to current levels. This would cause heavy disturbance over at least two generations before equilibrium was restored.

Under current management levels, area regulation would provide the ideal solution: an 80-year rotation wherein, during each 10-year period, 1.9 million acres would be harvested. This would allow an average annual harvest of 323 million cubic feet, an increase of 60 per cent over the present depletion rate.

However, with the existing tenure pattern, area control would be impossible to apply. More than half of New Brunswick's productive forest land is privately owned. Of the freehold properties, 56 per cent are in small holdings. To attempt effective regulation of areas cut, embracing both Crown licences and freehold properties, implies radical changes in the distribution of ownerships and in the powers exercised by the province. Such changes may ultimately take place, but for the present other methods of regulating the harvest must be examined.

Annual Allowable Cut and Current Utilization

Assuming the annual allowable cut to be equal to the annual incremental growth, New Brunswick's forests could - theoretically - support an annual cut of 766 million cubic feet (Table 1-22). However, at present natural mortality takes a toll of 269 million cubic feet annually, leaving a net annual increment of 497 million cubic feet. This is two-and-one-half times the current primary forest production of 190 million cubic feet. Industrial wood accounts for 90 per cent of current consumption; if we apply that proportion to the net annual increment, New Brunswick's annual industrial cut could be 450 million cubic feet.

Of the gross standing volume of 16.9 billion cubic feet, 25 per cent (4.3 billion cubic feet) is softwood sawlogs. At a 3 per cent growth rate,1/ the annual allowable cut of softwood sawlogs would be 129 million cubic feet or 645 million board feet. This suggests that the sawmill output of softwood lumber, at present about 270 million board feet, could be more than doubled. However, there are problems related to forest land tenure as well as cutting practice and accessibility. The softwood sawlog supply is distributed on the various holdings as follows:

1/ Provincial test plots indicate an annual gross growth rate of almost 4 per cent.

	000,000 f.b.m.
Small Holdings	1,852
Large Freehold	4,741
N.B. Crown	10,406
Federal Crown	150
All Owners	17,149

As can be seen, the bulk of softwood sawlogs is located on Provincial Crown holdings or in large freeholdings. Since 82 per cent of Provincial Crown lands is under lease to pulp and paper companies, and since the majority of large freeholdings are controlled by the pulp and paper companies, the difficulties in increasing the sawlog cut are obvious.

TABLE 1-22

Annual Gross Increment, New Brunswick Forests

District	Stocked Forest	Gross Increment Per Acre	Total Gross Increment
	000 acres	cu. ft.	000,000 cu. ft.
1	2,878	52.5	151
2	2,671	53.5	143
3	2,928	48.5	142
4	3,265	59.9	196
5	2,068	65.0	134
Total	13,810	--	766

Source: Original volume data and gross increment from New Brunswick Forest Inventory, 1958.

The production of hardwood lumber is about 30 million board feet annually.1/ Although the hardwood inventory shows a standing volume of 2,652 million cubic feet of hardwood in trees 10" d.b.h. and larger, most of it is of poor quality for lumber production.

At present, hardwood utilization is as follows:

	000 cu. ft.
Lumber, etc.	12,478
Fibre	4,717
Fuelwood	10,539
Total	27,734

1/ Atlantic Area Consultants show an annual utilization of 62 million board feet, but this includes uses other than lumber.

The net annual softwood increment in trees less than 10" d.b.h. is 190 million cubic feet, or just over 2.2 million cords (Table 1-23). Natural mortality accounts for an additional 104 million cubic feet, or 1.2 million cords (Table 1-24). Whether or not this mortality is salvageable is a matter of some debate. However, with increased utilization there is no doubt that mortality can be reduced.

TABLE 1-23

Volume Increment, Softwood Under 10" d.b.h., New Brunswick

District	Volume	Net Increment	Volume Increment
	000,000 cu. ft.	%	000 cu. ft.
1	1,634	1.9	31,046
2	1,988	2.1	41,748
3	1,538	3.4	52,292
4	1,326	2.9	38,454
5	1,162	2.3	26,726
Total	7,648	2.5	190,266

Source: New Brunswick Forest Inventory, 1958; Estimated Volume Changes, 1963 and 1964.

TABLE 1-24

Natural Mortality, Softwood Under 10" d.b.h., New Brunswick

District	Volume	Mortality	Volume Loss
	000,000 cu. ft.	%	000 cu. ft.
1	1,634	1.8	29,412
2	1,988	1.5	29,820
3	1,538	0.9	13,842
4	1,326	1.1	14,586
5	1,162	1.4	16,268
Total	7,648	1.4	103,910

Source: New Brunswick Forest Inventory, 1958; Estimated Volume Changes, 1963 and 1964.

In any event, the net increment is currently underutilized: at present 114 of 190 million cubic feet appears to be used annually for pulpwood. The balance of 75 million cubic feet (880,000 cords) would sustain at least another two or three pulpmills.

Hardwood, too, is underutilized. The net increment alone would permit increasing the current hardwood cut of 28 million cubic feet by 100 million cubic feet, or over one million cords, annually (Table 1-25). In addition, natural mortality - at least partly salvageable - accounts for 210,000 cords. The Ste. Anne Pulp and Paper Mill will consume about 300,000 cords annually, principally hardwoods. The establishment of a second hardwood-using kraft mill would certainly be feasible from the point of view of raw material.

TABLE 1-25

Volume Increment, All Hardwoods, New Brunswick

District	Volume	Net Increment	Volume Increment
	000,000 cu. ft.	%	000 cu. ft.
1	1,016	3.2	32,512
2	859	2.1	18,039
3	827	2.4	19,848
4	1,094	2.0	21,880
5	1,125	3.5	39,375
Total	4,921	2.7	131,654

Source: New Brunswick Forest Inventory, 1958; Estimated Volume Changes, 1963 and 1964.

Conclusion

New Brunswick can increase its annual harvest substantially for all types of products. Difficulties in achieving utilization more closely in accord with size classes arise from the present tenure of forest lands and the uneven distribution of age classes with respect to area. Increase of the annual cut to a level sufficient to remove over-mature timber would create large areas of unstocked or young growth forests; as noted earlier, this might lead - 40 years from now - to a forced reduction in production. The fact that the other Atlantic Provinces are essentially in the same position prevents an interprovincial traffic in primary forest products. Area regulation is important but appears to be impossible without radical changes in tenure arrangements. A partial solution lies in salvaging an increasing share of natural mortality, but this can only be achieved by a more intensive management of all areas.

Newfoundland and Labrador

Although more than half the combined area of Newfoundland and Labrador is forested, 60 per cent of the forested area is non-productive - that is, it is incapable of development to produce forests of commercial value. Of the 21.7 million acres of productive forest land, 8.3 million are in Newfoundland, 13.4 million in Labrador.

Standing volume of merchantable timber in 1967 was estimated to be 11.7 billion cubic feet - 5.1 billion in Newfoundland, 6.6 billion in Labrador. In both, the forests are predominantly softwood species (Table 1-26).

TABLE 1-26

Estimates of Merchantable[1/] Standing Timber Volume, Newfoundland and Labrador, 1967

Species Group	Volume		
	Island	Labrador	Total
	--------- 000,000 cu. ft. ---------		
Softwood	4,600	6,300	10,900
Hardwood	500	350	850
Total	5,100	6,650	11,750

1/ Stands containing more than 5 cords per acre of trees greater than 4" d.b.h.

Source: Newfoundland Forest Service.

Depletion by Fire

Non-forested land comprises a total area of about 12 million acres on the Island of Newfoundland. This is probably the result of forest fires striking the same areas repeatedly, destroying the already-thin layer of soils and laying bare large outcrops of rock.

Substantial expenditures to suppress fires in Newfoundland have been recorded since 1928. Indeed, the 1905 Act establishing the Anglo-Newfoundland Development Co. included provisions for forest fire protection. However, statistics classifying the areas burned are available only from 1946 (Table 1-27). The dramatic increase in acreage burned in the 1956-1965 period is due to the disastrous forest fires of 1961.

TABLE 1-27

Forest Areas Burned by Decade, Newfoundland (Island), 1946-1965

Period	Merchantable	Cut-Over	Young Growth	Waste and Recent Burn	Total
	000 acres				
1946-1955	76	82	84	324	566
1956-1965	1,579	59	69	997	2,704

Source: Newfoundland Forest Protection Ass'n. Annual Reports.

Age-Class Distribution of Softwood Stands

Because less than 10 per cent of the growing stock in Newfoundland is composed of hardwoods, interest is concentrated on softwood species. The distribution of softwoods among the major age-class divisions, as estimated by the Newfoundland Forest Service, is presented in Table 1-28.

TABLE 1-28

Age-Class Distribution, Softwoods, Productive Forest Land, Newfoundland (Island), 1967

Age Class	Area	Volume
	000 acres	000,000 cu. ft.
0-40	3,688	-
41-80	2,219	1,650
81+	2,473	2,950
Total	8,380	4,600

Source: Newfoundland Forest Service.

Forest Yield

To arrive at an estimate of sustained yields over an 80-year rotation, a series of preliminary estimates and assumptions must be made.

The provincial government's current estimate of allowable annual cut is 1.58 million cords (134 million cubic feet) annually. If this timber were cut from the oldest age classes (i.e., 81+) it would take 22 years to deplete this source. This assumes no appreciable growth within this class,

nor major losses through catastrophes. It also assumes that the burned productive areas are included in the 0-40 class and are more or less evenly distributed within each 10-year period.

By the year 1989-1990, the old timber would be depleted.1/ Area depletion would be at a rate of 112,000 acres per year. The assumption is made here, adopted from the Kennedy Commission, that the average volume is 14.4 cords per acre in stands 81 years and older. The Kennedy Commission estimated an average volume of 12.9 cords per acre for the age classes 61-80. From Table 1-28 it can be calculated that the average volume of softwood per acre is 8.8 cords for the 41-80 year age class and 14.2 cords per acre for the 81+ age class. Presumably some allowance is made for unsalvageable losses.

If the following estimates are accepted, possible yields may be inferred: no volume for 40 years or less; 8.8 cords per acre for 41-80 (with an adjustment for the 61-80 age class); and 14.2 for the 81+ age class. The results of these assumptions are illustrated in Figure 1-4.

The following average volumes may be read from Figure 1-4:

Age Class	Volume in Cords per Acre
41-50	2.4
51-60	6.7
61-70	11.0
71-80	13.6
81+	14.2

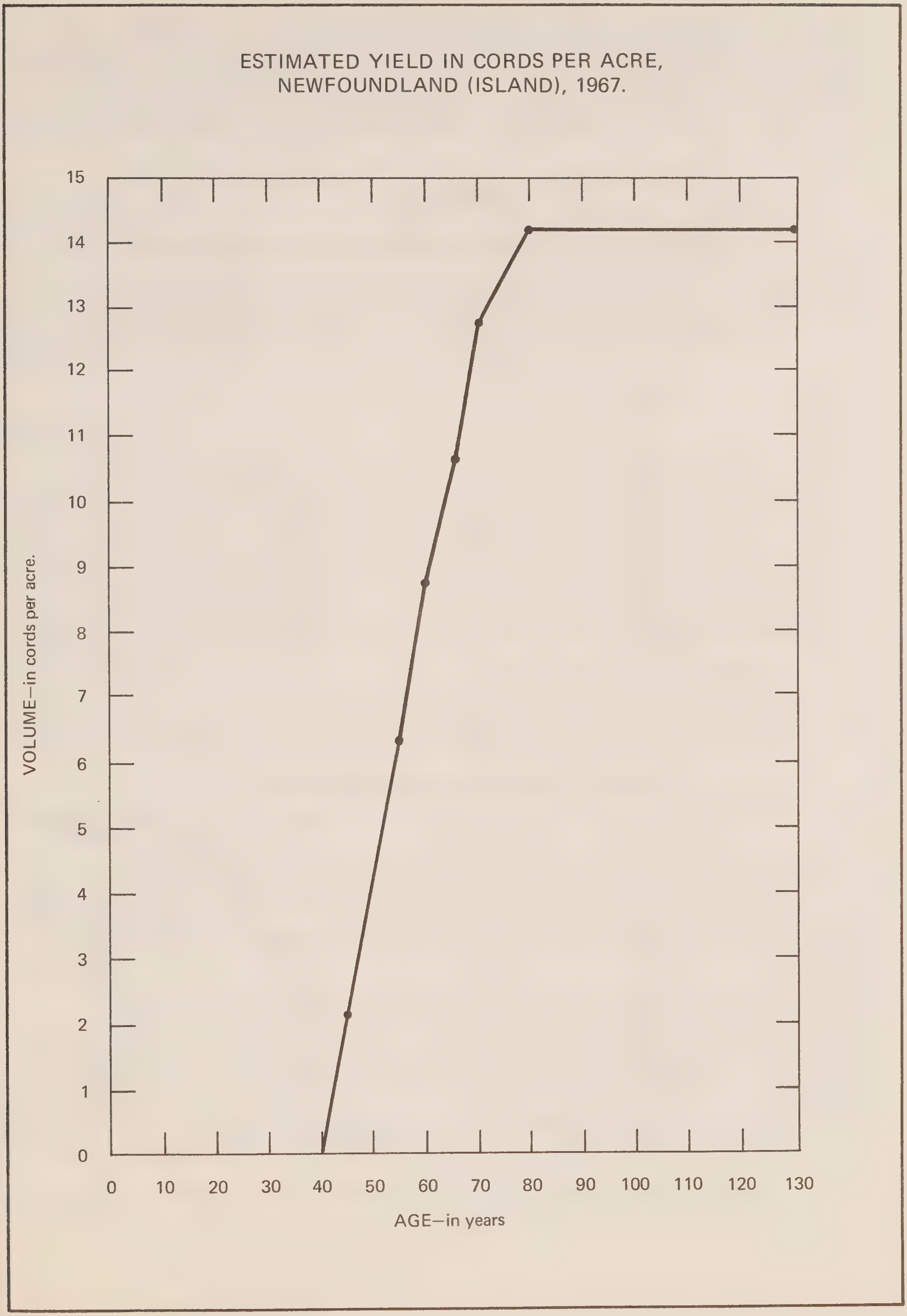
If these assumptions are correct, the annual allowable cut of 1.58 million cords is too high. However, the average volume per acre of mature stands will need to be raised only from 14.2 to 15.1 cords in order to sustain that annual allowable cut on a rotation of 80 years. The 15.1 cords per acre represents 60 per cent of the gross standing volume in site class V (the worst) of the Nova Scotia yield table. It is quite within the realm of possibilities.

On the assumption that it will be possible after 30 years to increase the average growing stock from 14.2 cords per acre to 15.1 cords per acre,2/ yields under a plan of area regulation may be estimated. The situation at present is estimated in Table 1-29. The total volume of 53.8 million cords is quite close to the volume estimate in Table 1-28. Totals of the age classes 41-80 and 81+ also compare favourably.

1/ This agrees with the estimate of the Newfoundland Royal Commission on Forestry (Kennedy Commission, 1955).

2/ It should be noted that, in light of present insufficient information, the average may already be 15.1 cords per acre.

FIGURE 1-4


ESTIMATED YIELD IN CORDS PER ACRE,
NEWFOUNDLAND (ISLAND), 1967.
VOLUME—in cords per acre.
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0
10
20
30
40
50
60
70
80
90
100
110
120
130
AGE—in years

In each of the first three 10-year periods of an 80-year rotation, 1,047,500 acres would be cut, which would produce less than the allowable cut, i.e., an average of 14.9 million cords per decade. Certainly in the first 10-year period, the allowable cut will not be reached. Expansion plans will be completed sometime in the middle of the first 10-year period.

TABLE 1-29

Estimated Forest Condition, Newfoundland (Island), 1967

Age Class	Area	Volume per Acre	Total Volume	
	000 acres	cords	000 cords	000,000 cu. ft.
1-10	2,017	-	-	-
11-20	557	-	-	-
21-30	557	-	-	-
31-40	557	-	-	-
41-50	555	2.4	1,332	112
51-60	555	6.7	3,719	316
61-70	555	11.0	6,105	519
71-80	554	13.6	7,534	640
81-90	1,124	14.2	15,961	1,357
91-100	1,124	14.2	15,961	1,357
101-110	225	14.2	3,195	272
Total	8,380	-	53,807	4,573

TABLE 1-30

Summary Plan, Forest Area Regulation

Period	Area Cut	Volume Cut	Total Growing Stock at End of Period	
	000 acres	000 cords	000 cords	000,000 cu. ft.
1967-1976	1,048	14,882	46,798	3,978
1977-1986	1,047	14,867	39,810	3,384
1987-1996	1,048	14,882	33,741	2,868
1997-2006	1,047	15,810	29,855	2,538
2007-2016	1,048	15,825	29,897	2,541
2017-2026	1,047	14,256	32,783	2,787
2027-2036	1,048	14,253	35,297	3,000
2037-2046	1,047	15,810	35,305	3,001

Given this plan, the level of growing stock will decrease rather drastically over the first rotation, from 53.6 to 35.3 million cords. The annual cut is not quite constant over the rotation, but at all times within 10 per cent of the allowable cut. Deficiencies can always be made up by imports from Labrador.

It is estimated that during 1965 the total cut on the Island was 1.05 million cords or 89 million cubic feet. Of this, 110,000 cords of pulpwood were exported. It is possible to divert this to local use once existing commitments for export are satisfied.1/

The proposed mill at Come by Chance is expected to be supplied with pulpwood from the Island, and will consume about 312,000 cords2/ per year. This will bring the total annual cut close to the allowable cut, without allowance for losses through fire and insects.

Labrador

No information is available for Labrador on which to base any reasonable projection. The Newfoundland Forest Service estimates that the annual allowable cut is of the order of 136 million cubic feet (1.6 million cords). It is planned to supply the proposed Melville Chemical & Cellulose Co. Ltd. mill in Stephenville entirely from Labrador. Its 350,000-ton kraft production will at most require 700,000 cords annually. This will leave sufficient raw material for the establishment of the proposed second mill at Stephenville, which at 800 tons per day, will consume approximately 375,000 cords per year.

These volumes of raw material required are well below the allowable annual cut. Any large discrepancy in age-class distribution which may exist in Labrador will not be significant at the anticipated level of cut.

Conclusion

Although the annual allowable cut of 1.58 million cords (134 million cubic feet) on the Island may be slightly high under the current level of forest management, there is no doubt that it is feasible. With the proposed expansion of pulp and paper production on the Island, this cut is fully committed.

Considerable expansion appears feasible in Labrador, although the current state of information on the forest resource does not permit any reasonable projection. It is estimated that the annual allowable cut is 1.6 million cords (136 million cubic feet) about half of which is committed.

1/ Under the terms of its present agreement with the province, Bowaters (Newfoundland) Ltd. is obliged to export 50,000 cords annually.

2/ Based on an input of 1.30 to 1.35 cords per ton of newsprint.

Prince Edward Island

Essentially, the forests on Prince Edward Island have the same history as those on the mainland. A century ago, white pine was the most important species, but it has now nearly disappeared. Because the forests are relatively small, management can be more intensive, which would raise both the growing stock and yield per acre. An estimated yield of 0.5 cord per acre per year therefore appears justified. This approaches the gross growth in New Brunswick, but is higher than the global estimate for Nova Scotia. Accessibility is probably better than in either of these provinces.

An estimated increase of 50 per cent in the annual yield seems therefore entirely feasible, from approximately 10 million cubic feet to 15 million cubic feet per year.

Summary

Nova Scotia (9.7 million acres of productive forest land)

	000,000 cu. ft.	% Increase
1. Current total annual wood consumption:	103	
2. Range of estimates of allowable softwood cut:	130-144	26- 40
3. Allowable cut, assuming pulpwood use only (softwoods and hardwoods):	200-224	94-117
4. Estimate of potential yield (assuming increased soil productivity or normal-yield-table stocking):	324	215

Under current levels of management, depending on the method of regulation, a sustained annual yield of softwoods is estimated at 130-144 million cubic feet. Hardwoods are estimated to have an annual growth of 80 million cubic feet, only 10 million of which are currently utilized.

New Brunswick (15.3 million acres of productive forest land)

	000,000 cu. ft.	% Increase
1. Current total annual wood consumption:	196	
Under present management (assuming harvest of the full net annual increment) this could be increased to:	497	166

	000,000 cu. ft.	% Increase
2. Softwoods greater than 10" d.b.h. -		
Current annual cut:	54 1/	
Allowable cut:	129 2/	139
3. Softwoods smaller than 10" d.b.h. -		
Current annual cut:	114	
Could be increased to:	190	67
4. Hardwood, all sizes -		
Current annual cut:	28	
Could be increased to:	132 3/	370

Newfoundland and Labrador (21.7 million acres of productive forest land)

Island. The annual allowable cut of 134 million cubic feet may be slightly high under current management practices, although altogether feasible potentially.

Labrador. The estimated annual allowable cut is 136 million cubic feet, of which about half is expected to be cut under present commitments.

Prince Edward Island

It is estimated the present annual cut of 10 million cubic feet could be increased by 50 per cent to 15 million.

1/ = 270 million f.b.m.

2/ = 645 million f.b.m. This is, however, of questionable quality; much is balsam fir.

3/ In addition, some salvage of natural mortality in the form of fuelwood is possible.

2. MARKETS FOR FOREST PRODUCTS

To attempt to forecast markets for forest products is hazardous. It is probably least risky to do so on a national basis. However, for the purposes of this report forecasts of national market prospects are not sufficient. At a minimum, regional forecasts are required, and forecasts by individual provinces preferred.

For pulp and paper, market forecasts were prepared by examining past growth trends. It was assumed that past growth rates mirrored the response of the industry to such significant factors as general economic conditions, transportation costs and fibre costs. Each of these factors was examined to see whether major changes could be expected in the period up to 1975. It was assumed that forecasts for larger geographical units were firmer than for smaller units, and that variations of rates in provincial and sub-regional units would be limited by estimates of regional or national growth. To preserve the national growth rate forecast, for example, growth rates of shipment from Eastern Canada could only grow at the expense of declines in British Columbia; or growth in Central Canada (Ontario and Quebec) could only be at the expense of other parts of Eastern Canada, since the growth rate for Eastern Canada was assumed to be stable. The forecast proceeded from the national, to regional, to sub-regional and provincial levels, with the forecast at the higher level providing the parameters within which the more detailed forecasts fitted.

For the lumber industry a somewhat different technique was employed. It was felt that markets have not been a major constraint on lumber production in Eastern Canada in general, or the Atlantic Region in particular. This proposition was tested by comparing trends in production with trends in local consumption. Domestic consumption was projected to 1975, and various levels of production were applied to see whether the proposition that markets were not a major constraint on lumber production was valid.

Pulp and Paper Marketing Outlook

During the 15 years from 1950 to 1965 Canada experienced a compound annual rate of growth in the physical volume of shipments of pulp and paper products of 3.7 per cent. However, all parts of the country did not share equally in this growth. British Columbia increased its physical volume of shipments by 10.1 per cent compounded annually during this 15-year period, while Canada, exclusive of British Columbia, increased by only 2.6 per cent. This differential rate of growth can be expected to continue. British Columbia's output has been growing because its natural market areas, the western United States and the countries of the Pacific rim, have been growing very rapidly, its wood costs have been relatively low and opportunities to obtain cutting rights in potentially valuable forest areas were very favourable.

The rate of growth in British Columbia, however, has little relationship to the rate of growth in Eastern Canada since they are not direct competitors, except on the margins. Eastern Canada's major markets are the Northeastern and Central United States, and potentially Europe. British Columbia, even with favourable wood costs, is not able to penetrate these markets to any great extent; assuming similar relative transportation costs (i.e., that transport costs, whether higher or lower, will still be linearly related to distance), it will not be able to do so in the future.

Tables 1-31 and 1-32 indicate the rate at which physical production of pulp and paper products has been growing in Canada, in Eastern Canada, in the Central Provinces, British Columbia and New Brunswick. Unfortunately, because of the confidentiality provisions of D.B.S. it is not possible to identify separately Atlantic Region production or Prairie Region production. However, certain major trends in the growth of shipments are clear. First, British Columbia has been growing more rapidly than Canada as a whole, or any other regional segment of Canada, both for the 15-year period from 1950 to 1965 and for any segment of it. Eastern Canada (i.e., Canada exclusive of British Columbia) has had exactly the opposite pattern, growing at less than the Canadian average over the whole 15-year period, and for any segment of it. Within Eastern Canada, Quebec and Ontario have been growing at a slower rate than Eastern Canada as a whole, both over the long term and for every five-year period except one (1952-57) when the Central Provinces' growth rate was slightly superior to that of Eastern Canada.

TABLE 1-31

Wood Pulp Production, Canada and Regions, 1950-1965

	Canada	British Columbia	Eastern Canada1/	Central Provinces2/	New Brunswick
	----------	----------	000 tons	----------	----------
1950	8,473	777	7,696	6,200	664
1951	9,315	924	8,391	6,767	717
1952	8,968	915	8,053	6,501	666
1953	9,077	1,071	8,006	6,487	677
1954	9,673	1,277	8,396	6,736	733
1955	10,151	1,364	8,787	7,093	760
1956	10,733	1,424	9,309	7,544	777
1957	10,425	1,376	9,049	7,352	725
1958	10,137	1,454	8,684	6,960	702
1959	10,832	1,927	8,905	7,132	716
1960	11,461	2,124	9,337	7,436	814
1961	11,779	2,256	9,523	7,559	822
1962	12,733	2,411	10,322	7,663	838
1963	12,474	2,501	9,973	7,806	907
1964	13,742	2,827	10,915	8,521	990
1965	14,573	3,275	11,298	8,807	1,114

1/ Canada less B.C.

2/ Quebec and Ontario.

Source: Pulp and Paper Mills. D.B.S.; New Brunswick, unpublished data. D.B.S.

TABLE 1-32

Rate of Growth 1/ of Physical Production of Wood Pulp, Canada and Regions, 1950-1965

	Canada	British Columbia	Eastern Canada 2/	Central Provinces 3/	New Brunswick
	%	%	%	%	%
1950-55	3.7	11.9	2.7	2.7	2.7
1951-56	2.9	9.0	2.0	2.0	1.7
1952-57	3.1	8.5	2.3	2.5	1.7
1953-58	2.2	6.3	1.6	1.4	0.6
1954-59	2.3	8.4	1.2	1.0	-0.4
1955-60	2.4	9.3	1.2	0.8	1.4
1956-61	1.9	9.7	0.4	0.1	1.1
1957-62	4.1	11.9	2.7	0.8	2.9
1958-63	4.3	11.5	2.7	2.4	5.3
1959-64	4.8	7.1	4.1	3.6	6.7
1960-65	4.9	9.0	3.9	3.4	6.4
15-year growth rate 1950-65	3.7	10.1	2.6	2.3	3.5
10-year rate 1955-65	3.7	9.2	2.6	2.1	3.9

1/ Five-year moving compound annual growth rates.

2/ Canada less B.C.

3/ Quebec and Ontario.

Source: Table 1-31.

New Brunswick, however, has had a quite different growth pattern. Its long-term 15-year growth rate has been substantially above that for Eastern Canada, and indeed has approached that for Canada as a whole. But even more significant is the pattern into which it falls, composed of the period before about 1958 and after. Before about 1958 growth rates in New Brunswick were generally below the levels for Eastern Canada. However, after this time they strengthened to run ahead of, first the Eastern Canadian average, and then the Canadian average as a whole.

Though it is impossible to obtain the actual physical production for the other Atlantic Provinces it is possible to obtain the dollar value of shipments for each province (Tables 1-33 and 1-34).

TABLE 1-33

Current Dollar Value of Shipments of Pulp and Paper, Atlantic Provinces, 1950-1965

	Newfoundland	New Brunswick	Nova Scotia
		$ 000	
1950	48,056	71,798	14,950
1951	59,959	94,066	18,574
1952	62,812	86,516	19,740
1953	61,436	83,075	19,359
1954	62,126	88,762	20,715
1955	62,616	94,403	21,084
1956	68,085	101,358	22,022
1957	63,303	94,521	21,790
1958	61,003	94,439	21,597
1959	62,508	96,446	21,439
1960	67,986	107,615	21,135
1961	73,725	108,468	21,698
1962	68,427	106,663	29,931
1963	70,436	113,306	34,507
1964	75,475	127,099	40,814
1965	74,115	141,082	40,304

Source: Pulp and Paper Mills. D.B.S.

TABLE 1-34

Rate of Growth[1] in Value of Shipments of Pulp and Paper, Atlantic Provinces, 1950-1965

	Newfoundland	New Brunswick	Nova Scotia
	%	%	%
1950 - 1955	5.5	5.6	7.2
1951 - 1956	2.5	1.5	3.5
1952 - 1957	0.1	1.8	2.1
1953 - 1958	-0.1	2.5	2.2
1954 - 1959	0.1	1.7	0.7
1955 - 1960	1.6	2.5	0.1
1956 - 1961	1.6	1.5	-0.3
1957 - 1962	1.6	2.4	6.0
1958 - 1963	2.9	3.7	9.8
1959 - 1964	3.8	5.6	13.8
1960 - 1965	2.1	5.6	13.8
15-year growth rates	2.9	4.6	6.8
10-year growth rates	1.7	4.1	6.7

1/ Five-year moving compound annual growth rates.

Source: Table 1-33.

It will be noted that the growth in value of shipments for New Brunswick did not expand as rapidly as the growth in the physical volume of shipments. In fact the dollar value per ton of product reached a peak in 1959 and has declined substantially since that time, contrary to the experience in Canada as a whole, and in the Central Provinces (see Table 1-35). This reduction in value per ton of product has been almost entirely due to changing product mix. The Central Provinces, particularly Ontario, have always been the location of the production of high-value end-products, such as fine papers, for the domestic market. New Brunswick's role has been to provide a cheap source of semi-processed products for the world market. Presumably Quebec's and Ontario's major advantage has been proximity to major Canadian markets.

TABLE 1-35

Current Dollar Value of Shipments Per Ton of Pulp and Paper Products, 1950-1965

	New Brunswick	Ontario	Quebec	Canada
	$	$	$	$
1950	108.18	130.33	107.51	112.61
1951	131.26	155.77	122.39	131.45
1952	129.94	148.39	121.21	129.11
1953	122.64	151.67	122.86	129.96
1954	121.20	130.76	123.35	128.36
1955	124.27	154.38	124.89	130.72
1956	130.48	161.45	128.50	136.49
1957	130.45	161.26	130.63	135.80
1958	134.47	163.38	133.03	137.44
1959	134.61	164.03	134.98	138.83
1960	132.27	161.50	134.52	138.12
1961	132.01	161.79	135.22	138.62
1962	127.23	166.56	140.20	134.79
1963	124.88	170.29	140.72	143.79
1964	128.38	168.87	141.14	144.38
1965	126.63	171.19	142.37	144.40

Source: Pulp and Paper Mills. D.B.S.

In examining the other provinces in the Atlantic Region it will be noted that Nova Scotia has had a growth pattern similar to New Brunswick's but at a much higher rate. This in part is due to the smaller size of its pulp and paper base, which has been strongly affected by the addition of one new mill. When Nova Scotia and New Brunswick combined are compared with Quebec and Ontario combined, the pattern of Maritime growth relative to that of the Central Provinces becomes clear (Table 1-36).

TABLE 1-36

Value of Shipments of Pulp and Paper and Rate of Growth, Maritime and Central Provinces, 1950-1965

Year	Value of Shipments: Quebec & Ontario	Value of Shipments: New Brunswick & Nova Scotia	Period	Rate of Growth[1]: Quebec & Ontario	Rate of Growth[1]: New Brunswick & Nova Scotia
	$ 000	$ 000		%	%
1950	721,166	86,748	1950-1955	5.9	5.9
1951	911,206	112,640	1951-1956	3.1	1.8
1952	850,737	106,256	1952-1957	4.1	1.8
1953	863,889	102,434	1953-1958	3.1	2.5
1954	897,321	109,477	1954-1959	3.1	1.4
1955	962,648	115,487	1955-1960	2.4	2.2
1956	1,059,615	123,380	1956-1961	0.7	1.1
1957	1,044,532	116,311	1957-1962	2.0	3.2
1958	1,008,937	116,036	1958-1963	3.2	4.9
1959	1,042,876	117,885	1959-1964	4.4	7.3
1960	1,079,552	128,750	1960-1965	4.6	7.2
1961	1,101,355	130,166			
1962	1,154,843	136,594	15 years		
1963	1,189,396	147,813	1950-1965	4.2	5.1
1964	1,294,734	167,913			
1965	1,350,576	181,386			

1/ Five-year compound annual growth rate.

Source: Pulp and Paper Mills. D.B.S.

Here again the Maritime growth rate was below that of the Central Provinces during the early 1950's, then rose above in the late 1950's, and has been running strongly ahead ever since. Newfoundland on the other hand has exhibited a pattern of very slow growth throughout the whole period, below that of the Maritime Provinces, Canada and the Central Provinces.

The reason for the varying performance of the several provincial pulp and paper industries requires some explanation. In Table 1-37 the distribution of laid-down costs per ton of newsprint in New York for a mill in Three Rivers is indicated. This mill is assumed to have "average" wood costs.

TABLE 1-37

Laid Down Cost Per Ton of Newsprint in New York

Item	Amount	Per Cent
	$ (Can.)	%
Transport and Selling Cost	15.70	16.64
Wood Cost	21.92	23.24
Wages, Salaries and Fringe Benefits	14.47	15.34
Electricity	8.00	8.48
Fuel	4.00	4.24
Chemicals and Additives	2.50	2.65
Other Materials, Overheads and Contingencies	15.00	15.92
Mill Fixed Capital - Depreciation	10.66	11.31
Interest on Working Capital	2.05	2.18
Total	94.30	100.00

Source: Haviland, W.E., N.S. Takacsy and E.M. Cape, Trade Liberalization and the Canadian Pulp and Paper Industry, University of Toronto Press, 1968.

The major variable costs of newsprint production and distribution are transportation costs, mill labour costs and wood costs. Almost all mills are on tidewater in the Maritimes, and they ship almost exclusively by sea. About one-third of Quebec production is shipped by water. It is assumed that transportation costs do not differ significantly between the Maritimes and Quebec.

Labour costs are similar; the average hourly production wages in 1965 were $2.53 per hour in New Brunswick, $2.55 in Quebec and $2.54 in Ontario.

It is in wood costs that the principal variation occurs. Table 1-38 indicates the cost of wood per cunit and per ton of fibre in the various provinces. From the viewpoint of the pulp and paper industry, the cost per ton of fibre is of major importance. Density of wood varies substantially between species, and since wood fibre is the essential constituent of pulp and paper products, it is fibre that the mill is purchasing, rather than cubic content of wood. The footnotes to this table indicate how estimates of the average density of millwood were obtained.

Differences in fibre costs go far toward explaining the variation in rates of growth. The extremely low fibre costs in British Columbia lie behind that province's high and continuous rate of growth, though it should be noted that British Columbia experienced the greatest increase in fibre costs over the 1962-65 period.

The reason for the slow growth of pulp and paper production in Newfoundland is also clear. Wood costs which, on a cubic basis, are below those of Quebec and Ontario, when expressed in fibre terms are seen to be the highest in Canada. Newfoundland has no offsetting advantage in location or mill labour cost.

TABLE 1-38

Wood and Fibre Costs, 1962-65

	Cost Per Cunit of Millwood				Density Per Cunit of Millwood 1/	Cost Per 2,000 lbs. of Oven Dry Wood Fibre			
	1962	1963	1964	1965		1962	1963	1964	1965
	$	$	$	$	lb.	$	$	$	$
Newfoundland	34.23	32.87	31.25	31.65	2,260	30.29	29.09	27.65	28.01
Nova Scotia	27.50	26.58	26.26	26.37	2,236	24.59	23.77	23.48	23.58
New Brunswick	26.30	26.58	27.58	27.57	2,224	23.65	23.91	24.81	24.79
Quebec	30.91	31.18	31.63	32.15	2,364	26.15	26.37	26.75	27.19
Ontario	34.03	33.82	33.12	33.05	2,487	27.36	27.19	26.63	26.57
British Columbia	17.07	19.15	22.67	21.12	2,520	13.55	15.19	17.99	16.76

1/ Pounds per 100 solid cubic feet, oven dry weight and green volume.

Source: Pulp and Paper Mills, 1962-65, D.B.S.; Unpublished data, D.B.S.

Note on Derivation of Densities:

Newfoundland - from Canadian Forestry Statistics 1963 Bulletin - D.B.S., determine the relative ratio of kinds of merchantable timber produced, in this case a 40:60 ratio of black spruce to balsam fir. Apply densities of spruce and fir to determine the average density of the wood produced. In this case 2,260.

Nova Scotia - from Hawboldt and Bulmer (1958) p. 77 - the percentage of species composition in Nova Scotia is given. The major species are balsam fir 38.33%, white spruce 12.96%, red spruce 27.35%, and black spruce 7.03%. Assume that these four species account for the total utilization in Nova Scotia in proportion to their occurrence. Apply individual density figures to these proportions to arrive at a composite density. In this case 2,236.

New Brunswick - from New Brunswick Forest Inventory 1958, the percentage of the annual cut drain by species in New Brunswick is given; the major species are 60% spruce, 38% fir and 5% pine. Apply density figures to determine the average density of the wood produced in New Brunswick. In this case 2,224.

Quebec - from Canadian Forestry Statistics, 1963 Bulletin, D.B.S. - determine the relative ratios of kinds of merchantable timber produced, in this case about 66% spruce and 33% fir. Apply density of spruce and fir to determine the average density of the mix of wood produced. In this case 2,364.

Ontario - from Canadian Forestry Statistics, 1963 Bulletin, D.B.S. - determine the relative ratios of kinds of merchantable timber produced, in this case about 15% fir, 60% spruce and 25% jack pine. Apply density figures to determine the average density of the mix of the wood produced. In this case 2,487.

British Columbia - density given in Table A-I of Trade Liberalization and The Canadian Pulp and Paper Industry by W.E. Haviland, N.S. Tackacsy and E.M. Cape.

New Brunswick's fibre costs are about 8.5 per cent below those in Quebec and Ontario, while Nova Scotia is about 13 per cent below the Central Provinces. Fibre costs are therefore seen to be closely related to the rates of growth in Maritime production noted earlier. New Brunswick and Nova Scotia, with lower fibre costs than Quebec and Ontario, have experienced faster growth rates than the Central Provinces. Newfoundland, with the highest fibre costs, has experienced the slowest growth rate while British Columbia, with the lowest fibre costs, has experienced the most rapid rate of growth. Presumably as long as these relative differentials in fibre costs remain, relative production growth rates will also remain.

Over the 15-year period from 1950 to 1965 the value of Canadian production of pulp and paper products in current dollars increased by 4.38 per cent per year. Price inflation in the pulp and paper industry has been a relatively minor factor. The composite industry selling price index in 1965 was 106.2, with 1956 as 100. This would suggest that about 0.6 per cent of the annual increase in current value of output is due to price inflation, and that the long-term average increase in output in constant dollars would be about 3.7 per cent, which is the rate at which physical production increased from 1950 to 1965.

In attempting to project the rate of expansion of the Canadian industry over the next decade, it is useful to examine growth expectations in the United States market. Resources for the Future (Landsberg, Fischman and Fisher: 1963) forecast increases in total consumption of paper and paperboard in the United States at the following rates:

	low	2.5%
1960 - 1970	medium	3.4%
	high	4.6%
	low	2.5%
1970 - 1980	medium	3.3%
	high	4.3%

The Canadian industry from 1960 to 1965 was expanding at a rate of 4.9 per cent per year. It is probable that the rate for the second half of the decade will be much less than this, with the likely result that expansion over the whole decade will be close to the medium forecast above, or the long-term Canadian rate of 3.7 per cent. The period from 1970 to 1975 should also see expansion close to the long-term Canadian average, with relatively low growth rates in the early 1970's, followed by higher growth rates toward the middle of the decade.

Eastern Canada's rate of growth should continue to be below that of Canada as a whole, largely because of the continued high rate of expansion in British Columbia and the slow population growth of Eastern Canada's prime market areas in the Northeastern United States, compared with the rapid growth in the Western United States. During the 1965-1975 period the rate of growth for the whole of Eastern Canada should be about 2.6 per cent per annum, the rate experienced both during the 15 years from 1950 to 1965, and during the last 10 years (<u>see</u> Table 1-32).

Within Eastern Canada, Quebec and Ontario should continue to grow at a rate below that for Eastern Canada as a whole. Over the 15 years

from 1950 to 1965 the Central Provinces expanded physical production at the rate of 2.3 per cent per year; during the 10 years from 1955 to 1965 at the rate of 2.1 per cent per year. During the decade 1965-1975 the rate might be expected to continue dropping slightly to 2.0 per cent per year. Newfoundland, because of its high wood costs, can only be expected to continue expansion at its long-term rate of 1.7 per cent per year. This does not allow for the addition of new mills in Newfoundland. The Maritime Provinces, Nova Scotia and New Brunswick, could then be expected to continue to increase production in line with their advantage in wood fibre costs at an annual rate of about 6.5 per cent.

The projected results of increases in production at these rates are summarized in Table 1-39.

TABLE 1-39

Projected Value of 1975 Pulp and Paper Production in 1965 Dollars

	Value of 1965 Production	Rate of Growth	Value of 1975 Production
	$ 000	%	$ 000
Eastern Canada	1,606,077	2.6	2,076,000
Quebec and Ontario	1,350,576	2.0	1,646,000
Newfoundland	74,115	1.7	88,000
Maritimes	181,386	6.5	340,000
			2,074,000

Assuming that the forecast for Eastern Canada as a whole is valid, these forecasts are interlocking. That is, no additional growth could be expected in any one part of Eastern Canada except at the expense of other parts. If the rate of growth in the Maritimes were to be increased it could only be at the expense of the Central Provinces and Newfoundland, and so on.

To increase Eastern Canada's share of the market in the United States would require the assumption that Eastern Canada could compete for a larger share of the market against British Columbia and United States domestic producers. This would certainly be very difficult in view of the fibre costs of the British Columbia and Southern United States producers.

Only spotty information on regional exports to foreign markets is available. Table 1-40 indicates the value of major forestry product exports from the Atlantic Region to non-Canadian destinations in 1966. The table identifies (a) shipments which originated in the region and cleared for foreign destinations from Atlantic ports and (b) shipments which originated in the region but cleared through other ports. The latter represent primarily shipments by rail, mainly to the United States.

With respect to pulp and paper, only 10 per cent of the value of ladings entered the export trade through other than Atlantic ports. This emphasizes the relatively minor role played by rail transport in the region's pulp and paper shipments. 1/ Nearly three quarters (74 per cent) of the region's pulp and paper exports went to the United States, with the United Kingdom accounting for 10 per cent. Only for one pulp and paper product - paperboard - did the United Kingdom claim the major share (55 per cent) of the region's exports.

It would seem that the only substantial pulp and paper market where the Atlantic Region and Eastern Canada as a whole might be expected to expand at a faster rate in the future is in Europe. Europe in the past has been a competitor in the North American market. This role has long since disappeared due to rising wood costs in the Scandinavian countries. At present it is estimated that Scandinavian wood costs "are at least $20 per ton of paper and paperboard higher than in Eastern Canada . . . and that the ocean freight rate between the eastern seaboard of North America and the western seaboard of Europe was about $20 per ton" (Haviland, Takacsy and Cape, 1968). Any combination of a rise in wood costs in the Nordic countries, or a decline in North Atlantic shipping costs would open the European market to Eastern Canadian producers.

1/ Exports of lumber and other sawmill products by rail are also of little importance, representing only 13 per cent of all lumber exports. In contrast to pulp and paper exports (except paperboard), however, the United Kingdom is the leading market for exported lumber, taking 53 per cent of the regional total. The United States is close behind with 41 per cent.

TABLE 1-40

Forest Products Exports to Foreign Markets, Atlantic Region, 1966 1/

Item	Destination		
	All Foreign	U.S.A.	U.K.
	$ 000		
I. Atlantic Region Point of Lading and Port of Clearance			
Logs - Round and Roughly Squared	344	146	36
Bolts of Wood	101	101	--
Round Timber	139	19	119
Pulpwood	18,446	5,955	3,008
Other Crude Wood Materials	1,057	1,022	--
Lumber	17,039	5,387	10,413
Other Sawmill Products	602	485	103
Veneer, Plywood and Wood Building Boards	456	62	351
Other Wood Fabricated Materials	219	124	87
Wood Pulp and Similar Pulp	66,797	52,743	9,696
Paper for Printing	155,920	105,119	15,003
Paperboard	5,449	44	3,072
Converted Paper	462	8	209
Containers and Closures	100	74	3
Other Wood and Wood Products	235	62	42
Sub-Total	267,366	171,350	42,140
II. Atlantic Region Point of Lading, Cleared Through Other Ports 2/			
Pulpwood	80	80	--
Other Crude Wood Materials	1,385	1,369	--
Lumber	2,540	2,490	50
Other Sawmill Products	227	88	129
Other Wood Fabricated Materials	256	140	109
Wood Pulp and Similar Pulp	17,281	17,232	--
Paper for Printing	7,756	7,512	179
Paperboard	383	2	136
Other Wood and Wood Products	103	22	--
Sub-Total	30,011	28,935	603
III. Total - All Forestry Products	297,377	200,285	42,743
Per Cent	100.0%	67.3%	14.4%

1/ Derived from data identifying Point of Lading (Reg. L.A.) and Port of Clearance (Reg. C.L.) of export shipments. It is assumed that any shipment with Point of Lading in the Atlantic Region represents Atlantic Region production.

2/ Largely shipments by rail.

NOTE: Columns may not add to totals due to rounding.

Source: Unpublished data, D.B.S.

Scandinavian wood costs are likely to increase in the future since they have no substantial unutilized wood resources. Increased wood production can only occur at the cost of substantial additional inputs into forest management, which are likely to raise wood costs. There is, however, the possibility of competition from the U.S.S.R. which has extensive forests of pulping quality, and a locational advantage with respect to European markets. Ocean transport costs for pulp and paper products are unlikely to decline substantially in the future. Container developments will not affect pulp and paper products very much, since these products are already shipped in very large containers, such as newsprint rolls.

Some growth of overseas markets has already been assumed in the growth rates for Eastern Canada, since these markets have contributed to past Eastern Canadian growth, particularly in Newfoundland and the Maritimes. However, any very substantial additional growth of the European market, at least up to 1975, seems unlikely.

The addition of the two proposed mills in Newfoundland, which by 1975 could be expected to be producing shipments to the value of about $64.5 million, could therefore only be accommodated by a reduction in the rate of growth of shipments from other regions of Eastern Canada (under the assumptions adopted for this market estimate). Since Quebec and Ontario are primarily dependent on rail markets, where Newfoundland could not be expected to compete, the bulk of reductions in shipments would likely be experienced by the Atlantic Region. To attract new development the Government of Newfoundland has had to provide substantial subsidies, which are intended to reduce the costs of operation of new mills in Newfoundland. The level of costs which such a reduction must achieve is one at or below that of the next most attractive site on tidewater in Eastern Canada. This means that new mills in Newfoundland must be able to anticipate costs comparable to mills in the Maritimes and Quebec, where operating costs (as measured by wood fibre costs) would seem to be below levels in the existing Newfoundland mills.

It might be argued that the existing mills in Newfoundland could still afford to expand production, even though their basic wood costs are higher, because of an advantage in marginal costs of installing new capacity. This seems unlikely, however. Examination of Table 1-37 indicates that fixed costs are a relatively minor portion of laid-down costs per ton of newsprint; 11.3 per cent of such costs are attributable to depreciation on fixed capital.

This analysis leads to the conclusion that, if the new mills are established, the $14 million expansion in output by existing Newfoundland mills forecast for 1975 in Table 1-39 is unlikely to take place. Estimated 1975 production by province, reflecting the anticipated effect of the two proposed mills in Newfoundland, is shown in Table 1-41.

TABLE 1-41

Projected Value of 1975 Pulp and Paper Production (1965 Dollars) Assuming Two New Mills in Newfoundland

	Value of 1965 Production	Rate of Growth	Value of 1975 Production
	$ 000	%	$ 000
Eastern Canada	1,606,077	2.6	2,076,000
Quebec & Ontario	1,350,576	1.9	1,630,000
Newfoundland	74,115	6.5	139,000
Maritimes	181,386	5.4	307,000
			2,076,000

In summary, the rates of expansion in the value of pulp and paper shipments which were established for the various regions and provinces of Canada from 1955 to 1965 should hold without much change to 1975. The main controlling factor in future expansion is the relative cost of fibre at the mill. Within Eastern Canada, New Brunswick and Nova Scotia produce fibre at least cost, Newfoundland at highest cost. Other things being equal, then, the Maritimes can expect a growth rate of about 6.5 per cent and Newfoundland about 1.7 per cent per year, compared to a rate of about 2.0 per cent in Quebec and Ontario.

The effect of adding two new mills in Newfoundland of the capacity planned (given the apparent level of provincial subsidy) is likely to be twofold: Newfoundland's increased share of the market will be attained largely at the cost of a lower rate of expansion in the Maritimes; and the existing mills in Newfoundland are not likely to participate in the expansion.

Lumber Marketing Outlook

Tables 1-42 and 1-43 illustrate the long- and short-term trends in lumber production in the Atlantic Region. Five-year intervals are shown from 1910 to 1950, while annual production figures are shown from 1950 to 1965. Newfoundland figures are available only for the period following 1950.

Table 1-44 shows the provincial growth (or decline) in production by five-year moving averages, with longer term 10- and 15-year growth rates indicated as well. For the Atlantic Region the long-term picture is one of continued decline of about 1 per cent per year in volume of lumber production. In the provinces experiencing the severest decline, Newfoundland and Prince Edward Island, the rate of decline seems to be accelerating. In Nova Scotia, though decline remains persistent, there is no evidence to indicate that the rate is accelerating. In New Brunswick, in contrast, it would seem that the decline in evidence up to 1958 has been arrested and converted into a modest increase.

TABLE 1-42

Annual Lumber Production, 5-Year Intervals, Maritime Provinces, 1910-1945

	New Brunswick	Nova Scotia	Prince Edward Island	Total
	000,000 f.b.m.			
1910	419	261	5	685
1915	634	294	8	936
1920	516	270	6	792
1925	405	95	4	504
1930	276	129	5	410
1935	231	140	6	377
1940	297	286	4	587
1945	269	251	9	529

Source: Canadian Forestry Statistics. D.B.S.

TABLE 1-43

Annual Lumber Production, Atlantic Provinces, Central Provinces and British Columbia, 1950-1965

Years	Nfld	P.E.I.	N.S.	N.B.	Atlantic Region	Que.	Ont.	Eastern Canada	B.C.
	000,000 f.b.m.								
1950	45.3	11.6	281.2	299.0	637.0	1,129.4	820.0	2,586.2	3,508.8
1951	42.0	10.5	332.0	292.1	676.4	1,183.0	820.7	2,680.1	3,724.0
1952	55.1	9.4	297.0	260.0	621.4	1,094.0	840.5	2,555.7	3,696.5
1953	49.0	10.5	296.0	335.1	690.4	1,200.6	823.7	2,714.7	4,045.7
1954	30.7	8.8	273.6	227.4	540.5	1,099.0	721.7	2,361.3	4,378.7
1955	32.7	9.6	353.7	275.2	671.2	1,025.1	760.0	2,456.2	4,914.3
1956	31.1	7.5	285.6	281.0	605.2	1,177.5	776.7	2,559.5	4,735.0
1957	38.6	8.4	255.7	249.7	552.4	1,064.2	671.5	2,288.2	4,412.4
1958	29.0	7.5	198.5	236.4	471.3	910.5	583.3	1,965.1	4,850.0
1959	38.0	8.0	220.5	308.3	574.6	1,038.4	621.0	2,234.0	4,948.6
1960	28.6	8.6	232.1	277.8	547.1	1,115.8	628.7	2,291.6	5,305.1
1961	25.5	8.0	197.6	270.0	501.0	980.6	628.2	2,109.7	5,607.4
1962	20.5	7.0	205.5	289.7	522.6	1,121.5	622.3	2,266.4	5,962.1
1963	17.2	5.8	216.0	287.1	526.1	1,250.5	717.3	2,494.0	6,616.5
1964	16.8	5.5	206.5	352.4	581.2	1,373.7	753.5	2,708.4	6,913.6
1965	13.3	6.1	204.8	324.0	548.0	1,410.0	793.0	2,751.0	7,019.2

Source: Canadian Forestry Statistics 1959, 1960, 1961, 1963, 1964, 1965. D.B.S.

TABLE 1-44

Growth Rates[1] of Lumber Production, 1950-1965

Years	Nfld.	P.E.I.	N.S.	N.B.	Atlantic Region	Que.	Ont.	Eastern Canada	B.C.
	%	%	%	%	%	%	%	%	%
1950-1955	-5.0	-3.2	+4.7	-1.5	+1.0	-1.8	-1.4	-1.0	+7.0
1951-1956	-4.7	-5.1	-2.6	-0.7	-2.0	-0.1	-1.0	-0.9	+4.9
1952-1957	-5.4	-2.1	-2.6	-0.8	-2.2	-0.5	-3.7	-2.0	+3.6
1953-1958	-7.1	-5.2	-5.8	-5.3	-5.6	-4.4	-5.3	-5.0	+3.7
1954-1959	+4.3	-2.0	-3.6	+6.3	+1.2	-1.1	-2.6	-1.0	+2.5
1955-1960	-2.4	-2.0	-6.1	-4.0	-3.5	+1.7	-3.2	-1.3	+1.6
1956-1961	-3.4	+1.0	-5.5	-0.8	-3.2	-3.1	-3.6	-3.3	+3.4
1957-1962	-8.0	-3.2	-3.7	+3.0	-1.0	+1.1	-1.4	-0.1	+6.2
1958-1963	-7.0	-4.3	-1.7	+4.0	+2.2	+6.5	+4.2	+4.9	+6.4
1959-1964	-9.2	-5.6	-1.2	+2.7	+0.2	+5.7	+4.0	+3.9	+6.9
1960-1965	-8.9	-5.3	-2.3	+3.1	+0.1	+4.8	+4.8	+3.7	+5.8
1955-1965	-4.7	-3.2	-3.6	+1.6	-1.7	+3.3	+0.4	+1.1	+3.6
1950-1965	-3.6	-2.6	-1.6	+0.5	-0.9	+1.4	-0.2	+0.4	+4.8

1/ Five-year compound annual growth rates.

Source: Table 1-43.

Of the other provinces only British Columbia has experienced continued growth throughout the 15-year period. In Quebec and Ontario persistent declines before 1960 have been transformed to modest growth in Quebec, and stability in Ontario.

In Table 1-45 the relationship of the domestic market to local production is examined. Provincial consumption of lumber is estimated by a method employed by Resources for the Future (Landsberg, Fischman and Fisher, 1963). Resources for the Future estimated the amount of lumber used per new dwelling unit, per dollar of new non-residential construction and per dollar of residential and non-residential maintenance. Lumber use per unit of construction has been declining both because of the increasing substitution of other materials, and because of the increase in apartment units, which use less lumber than single-family houses. If consumption of lumber in the Canadian construction industry is similar to the American pattern, provincial lumber consumption would be of the amount indicated in Table 1-45.

Table 1-45 indicates that Newfoundland and Prince Edward Island, which started the decade with small surpluses in production, ended it with deficits. Local production amounted to only about one-fifth of local consumption in Newfoundland and one-half in Prince Edward Island by 1965. Nova Scotia, which commenced the decade with production five times consumption, ended it with production only 1.4 times consumption; New Brunswick, which entered the decade with production 3.5 times consumption, ended it with production about 2.4 times consumption. For the region as a whole, production which was 3.3 times consumption in 1955, declined to 1.2 times consumption in 1965. In the remainder of Eastern Canada, Quebec - which is a surplus producer - declined from production 72 per cent greater than consumption in 1955, to a position where production was 55 per cent greater than provincial consumption in 1965. Ontario, which produced 12 per cent less than it consumed in 1955, by 1965 was producing 28 per cent less than its estimated lumber consumption.

Production in Eastern Canada as a whole, which was 52 per cent greater than consumption in 1955, was only 21 per cent greater than consumption in 1965.

Since the domestic market is the one which is least costly to service, and most protected from outside competition, its obviously increasing importance should tend to strengthen the position of Eastern Canadian producers. The increase in the domestic market has been of the most obvious benefit to the Quebec producers. Their own provincial market expanded by 312 million f.b.m., while the Ontario market increased by about the same amount. Quebec production increased by about 385 million f.b.m. between 1955 and 1965, the most of any of the Eastern Canadian provinces. Eastern Canada, of course, cannot produce all of the grades and types of lumber that it consumes itself; much still continues to be imported from British Columbia. However, with the growth of local consumption more of the material of lower grade and smaller size can be disposed of locally, leaving for export only the better-grade and larger-size product.

TABLE 1-45

Provincial Consumption and Production of Lumber, Eastern Canada, 1955-1965

Years	Actual Production	Estimated Consumption	Production Less Consumption	Production as % of Consumption	Actual Production	Estimated Consumption	Production Less Consumption	Production as % of Consumption
	000,000 f.b.m.			%	000,000 f.b.m.			%
Newfoundland					Prince Edward Island			
1955	32.7	30.4	+ 2.3	107.7	9.6	6.4	+3.2	149.3
1956	31.1	33.0	- 1.8	94.4	7.5	7.0	+0.5	107.6
1957	38.6	33.2	+ 5.4	116.4	8.4	6.2	+2.2	135.8
1958	29.0	34.3	- 5.4	84.3	7.5	6.6	+1.0	114.0
1959	38.0	51.3	-13.5	73.8	8.0	10.3	-2.4	77.2
1960	28.6	50.0	-21.4	57.2	8.6	10.6	-2.0	80.9
1961	25.5	55.4	-30.0	46.0	8.0	14.8	-7.0	53.1
1962	20.5	63.8	-43.3	32.1	7.0	13.5	-6.5	51.5
1963	17.2	62.2	-45.0	27.7	6.8	12.7	-7.0	45.3
1964	16.8	61.0	-44.1	27.7	5.5	11.4	-6.0	48.2
1965	13.3	60.3	-47.0	22.1	6.1	12.4	-6.3	49.0
Nova Scotia					New Brunswick			
1955	353.7	58.0	+295.7	610.0	275.2	60.8	+214.4	452.6
1956	285.6	62.8	+222.8	455.0	281.0	63.5	+217.5	442.4
1957	255.7	61.4	+194.3	416.2	249.7	56.0	+193.6	445.6
1958	198.5	58.2	+140.4	341.3	236.4	65.6	+170.8	360.3
1959	229.5	79.0	+141.6	279.4	308.3	62.7	+245.5	491.4
1960	232.1	80.8	+151.2	287.1	277.8	54.0	+223.8	514.6
1961	197.6	77.0	+120.6	256.7	270.0	55.0	+215.0	491.5
1962	205.5	74.0	+131.5	277.7	289.7	52.8	+236.8	548.3
1963	216.0	76.1	+140.0	284.0	287.1	52.4	+234.7	547.7
1964	206.5	72.7	+133.7	284.0	352.4	66.5	+286.0	530.0
1965	204.8	85.2	+119.5	240.2	324.0	95.4	+228.5	339.6
Atlantic Region					Quebec			
1955	671.2	155.6	+655.6	431.4	1,025.1	598.4	+426.7	172.0
1956	605.2	166.2	+439.0	364.1	1,177.5	691.6	+486.0	170.3
1957	552.4	156.8	+395.6	352.2	1,064.2	677.0	+387.3	157.2
1958	471.3	164.6	+306.7	286.3	910.5	724.2	+186.3	125.7
1959	574.6	203.3	+371.4	282.7	1,038.4	724.0	+314.4	143.4
1960	547.1	195.5	+351.6	279.7	1,115.8	639.7	+476.1	174.4
1961	501.0	202.2	+298.8	247.8	980.6	649.7	+331.0	151.0
1962	522.6	204.1	+318.5	256.0	1,121.5	702.0	+419.5	159.8
1963	526.1	203.4	+322.7	258.7	1,250.5	729.3	+521.2	171.5
1964	581.2	211.5	+369.7	274.8	1,373.7	860.0	+513.8	159.8
1965	548.0	253.3	+294.7	216.3	1,410.0	910.8	+499.1	154.8
Ontario					Eastern Canada 1/			
1955	760.0	861.0	-101.0	88.3	2,456.2	1,615.0	+841.4	152.1
1956	776.7	933.0	-156.1	83.3	2,559.5	1,790.6	+769.0	143.0
1957	671.6	986.5	-315.0	68.1	2,288.2	1,820.3	+467.8	125.7
1958	583.3	1,071.8	-488.4	54.4	1,965.1	1,960.6	+ 4.5	100.2
1959	621.0	964.8	-344.0	64.4	2,234.0	1,892.1	+341.8	118.1
1960	628.7	905.7	-277.0	69.4	2,291.6	1,741.0	+550.7	131.6
1961	628.2	863.7	-235.4	72.7	2,109.7	1,715.5	+394.2	123.0
1962	622.3	922.8	-300.5	67.4	2,266.4	1,829.0	+437.5	124.0
1963	717.3	925.7	-208.4	77.5	2,494.0	1,858.4	+635.5	134.2
1964	753.5	1,034.1	-280.6	72.9	2,708.4	2,105.5	+603.0	128.6
1965	793.0	1,106.5	-313.5	71.7	2,751.0	2,270.6	+480.3	121.2

1/ Eastern Canada includes the Atlantic Region, Quebec and Ontario.

It will be noted that, in spite of the increase in local consumption between 1955 and 1965, the Atlantic Region still has a large surplus that must be exported. In this respect Atlantic producers are relatively more dependent upon exports than are Quebec and Ontario producers. Quebec and Ontario, with a production in 1965 of 2,203 million f.b.m. had a surplus to local consumption of only about 185 million f.b.m. However, the Atlantic Region's surplus of production over local consumption, which stood at about 655 million f.b.m. in 1955, had declined to about 295 million f.b.m. in 1965. This apparent surplus is very small in comparison with total Canadian export markets. The apparent Atlantic Region surplus in 1965 represented only 4.5 per cent of total Canadian exports in that year. The region is obviously not in a position to influence the market. Atlantic Region lumber exports are but a small fraction of Canadian lumber exports to overseas markets. Therefore the region's position in these markets is not primarily due to the growth or decline of the overseas market as such, but the share of the market that it retains in competion with other Canadian lumber exporters. British Columbia exports to the United Kingdom have now reached the scale where producers can charter, on long term, specially designed lumber carrying vessels, land their product at docks specially constructed to handle British Columbia lumber, and establish a marketing chain to handle their product. The Atlantic Region's lumber producers retain the conventional shipping and marketing methods, which are sufficient to handle the declining volume of their export lumber.

Markets are not really a major problem for the region's lumber producers. Production in the region has declined slightly (about 1 per cent per year) over the last 15 years, local consumption has expanded substantially at about 5 per cent per year for the 10 years between 1955 and 1965, and the volume of lumber available for export, and the share of the market necessary to dispose of it, have both declined. Lumber production has declined, not because of declining markets, but because of the lack of suitable sawtimber.

The shortage of suitable sawtimber in turn is not due to the lack of the basic resource. There is sufficient sawtimber in the Maritime Provinces to support an industry at least twice the size of the existing one. The problem is rather one of the distribution of suitable sawtimber. The best sawlog stands are under the control of the pulp and paper companies, while sawmills have, on average, only two or three years of sawlog supplies in sight. There is little point in expanding the region's lumber market, and there is no dynamic to do so, when the industry is so constrained by the lack of raw materials. Only if some form of integrated utilization is achieved, whereby suitable sawlog material from the pulp and paper companies' timber holdings is directed to sawmills (as is the case with some pulp and paper companies at present), would production expand to the point where market constraints become important.

If Nova Scotia's cut were to expand to 350 million f.b.m. 1/ and New Brunswick's cut were to expand to 500 million f.b.m., which is within its annual sustainable yield, then the total cut in the Atlantic Provinces

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1/ This was the 1955 level of production, which has since declined. Given the necessary structural changes in the industry and access to available sawlog-sized timber, this level of production could undoubtedly be sustained.

would be of the order of 870 million f.b.m. By 1975 it is estimated that consumption in Eastern Canada would have increased to about 2,685 million f.b.m., of which 280 million f.b.m. would be attributable to the Atlantic Provinces. If it is assumed that the Central Provinces continue to increase production at about their long-term rate they could be expected to produce about 2,410 million f.b.m. The total surplus of production over consumption in Eastern Canada would then be about 600 million f.b.m., about the same level as in 1963 and 1964. With the forecast growth in consumption in Eastern Canada no conceivable expansion of the Atlantic Region lumber production would create insuperable marketing problems.

The most likely development would, however, see very little growth in Atlantic Region production, and thus a continually improving market position. The forecast in Table 1-46 shows the most probable trends in the growth of production and consumption of lumber to 1975.

TABLE 1-46

Forecast of Production and Consumption of Lumber to 1975, Atlantic Provinces and Central Provinces

Province	Production			Consumption	
	Actual 1965	Rate of Growth	Forecast 1975	Estimate 1965	Estimate 1975
	000,000 f.b.m.	%	000,000 f.b.m.	000,000 f.b.m.	
Newfoundland	13.3	-3.6	7.5	60.3	86.0
P.E.I.	6.1	-2.6	4.3	12.4	15.4
Nova Scotia	204.8	-1.6	169.5	85.2	93.0
New Brunswick	323.9	+0.5	340.4	95.4	87.0
Atlantic Region	548.1		521.7	253.3	282.1
Quebec	1,409.9	+1.4	1,620.2	910.8	1,082.3
Ontario	793.0	0.0	793.0	1,106.5	1,319.8
Central Provinces	2,202.9		2,313.2	2,017.3	2,402.1

By 1975, in addition to disposing of more of its production locally, the Atlantic Region should be able to supply increasing amounts to the central Canadian markets. Markets therefore do not represent, within the orders of magnitude of feasible physical expansion, a major constraint on the development of the lumber industry in the region.

3. WOODS OPERATIONS

The methods of harvesting pulpwood and sawlogs in Eastern Canada are in a state of transition. In pulpwood logging we are in fact now operating at three stages of development. The conventional "cut and pile" method, with its high labour component has been until recently the most commonplace pulpwood logging method in Eastern Canada, and is still widely used. The more advanced, partly mechanized system based on the skidding of tree lengths by articulated, rubber-tired skidders has grown very rapidly in the last few years and now accounts for perhaps 65 per cent of all eastern pulpwood production. Third, there is a growing number of applications of such systems as the Beloit Harvester and the Arbomatik, representing the stage of almost complete mechanization.

The first stage noted above is a discontinuous man-and-horse method using a chain saw in the felling and wood preparation process, and subsequently a horse in the primary movement to a truck road. There is generally a lengthy delay between the two phases of the method and it involves a redundant "pile-unpile" operation. The second stage sees the replacement of the horse in the primary movement from the stump to the truck road by a power skidder, permits a more efficient flow of the product and an improved layout of the operation. It facilitates a year-round approach to the process. The third-stage systems combine the advances thus achieved with the use of manually controlled machines to fell, limb, and top the trees and assemble bunches of merchantable boles or bolts.

The situation in the Atlantic Region cannot properly be described in isolation because it is hinged on what is happening in Ontario and Quebec where most of the developments originated and where the research, design, and most of the testing is going on.

Direction of Technological Developments

Although scarcity of woods labour during World War II forced some action in the 1940's to develop better productivity in Eastern Canadian wood harvesting, not until 1950 was there an attempt to rationalize mechanization. In that year the pulp and paper industry authorized the Executive Council of the Woodlands Section of the Canadian Pulp and Paper Association to engage engineering staff to analyse the processes of wood harvesting and to start the development of a suitable machine that could be applied to the task.

These efforts bore fruit. The analysis resulted in a definition of the problems and development of a concept of three systems through which complete mechanization could take place. This, in turn, provided an incentive and a focus for individuals and equipment manufacturers to start the design of components for these three systems.

The machine which has gained widest acceptance to date is the wheeled skidder.1/ Although conceptually a part of the fully mechanized tree-

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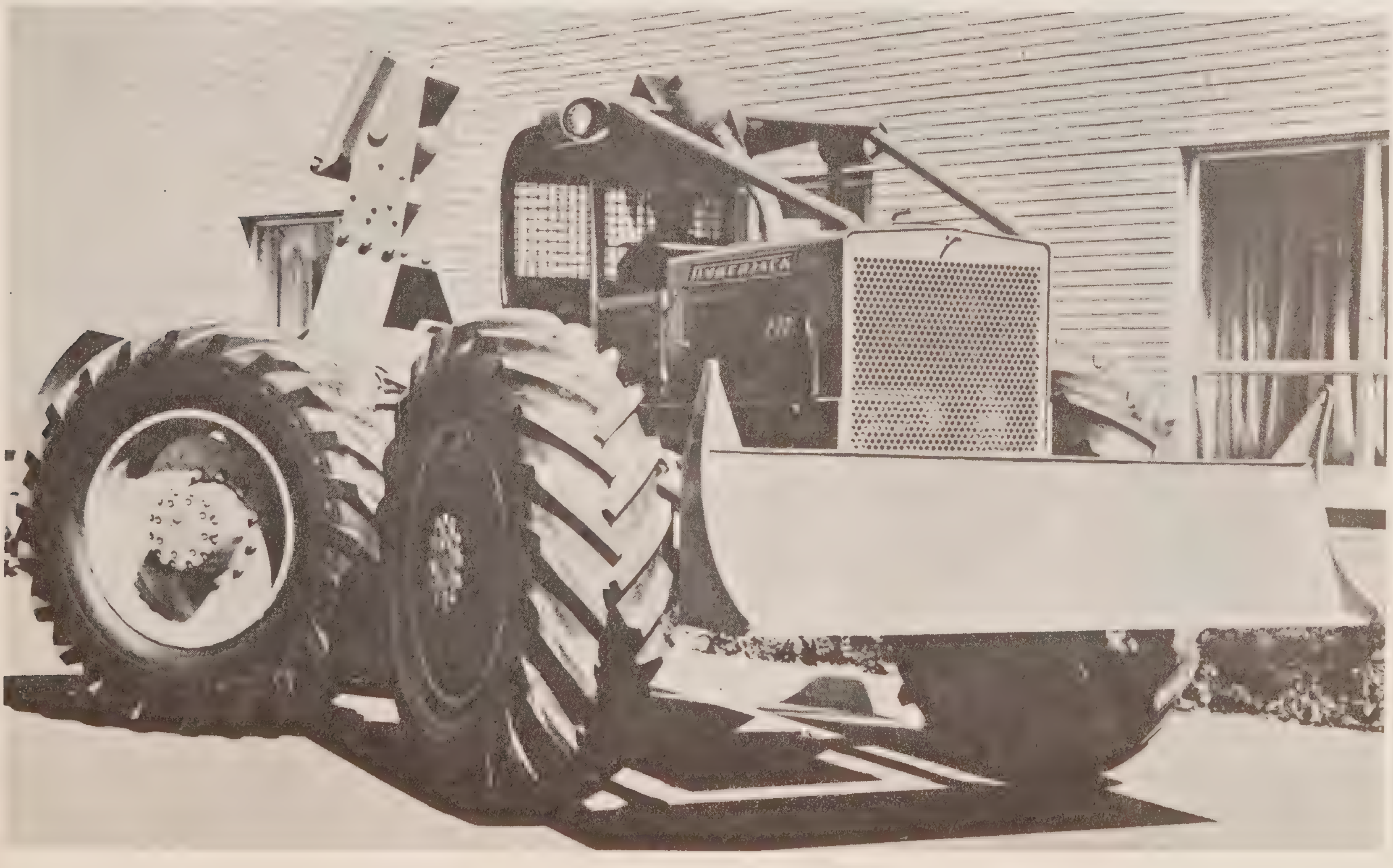
1/ The term "skidder" subsequently in this report is used to denote a wheeled vehicle incorporating a winch and fairlead which serve to elevate one end of a load of tree boles and to drag it to the delivery point. Modern units have four-wheel drive and articulated-frame steering. See Figure 1-5.

FIGURE 1-5

ARTICULATED-FRAME SKIDDER



length system of logging where it finds its greatest usefulness, the skidder has been more widely applied, especially in the Atlantic Region, for a number of reasons:

1) By means of a minor modification it has found a place in the still popular cut-and-pile method, especially in New Brunswick, Nova Scotia, and Newfoundland.

2) It has exceptional mobility. By modifying wheel and tire size it can be used successfully on soft terrain such as muskeg and more importantly on deep snow (up to about 40"). It therefore provides the means whereby the seasonal pattern imposed by snow cover can be largely overcome.

3) It has overcome the limitation of the horse and permits the re-design of the operation. Because it can skid longer distances economically, it has the effect of widening the road spacing by a factor of two to five and reduces the mileage of road correspondingly.

4) As a corollary of (3) above - it has become feasible to build a better class of road, at least on the better drained soils, making them suitable for summer trucking. One of the outstanding achievements of the skidder has been to make it feasible to convert woods <u>hauling</u> operations from a winter to a nine- or ten-month operation. In fact it has been instrumental in some instances in converting the <u>whole operation</u> from a basically fall-winter to a summer-fall pattern. However, this shift has not effectively lengthened the working season, as has occurred in Ontario. A somewhat lighter snowfall in Ontario facilitates mechanized operations in winter. In addition, the Ontario forest labour force is more mobile; therefore woods operators have a stronger incentive to retain workers through a longer season.

5) The skidder is applicable equally to pulpwood and sawlog production and in fact facilitates a combined or integrated operation.

6) It has increased the man-day productivity of the cutting-prehaul phase of the operation by about 25 per cent.

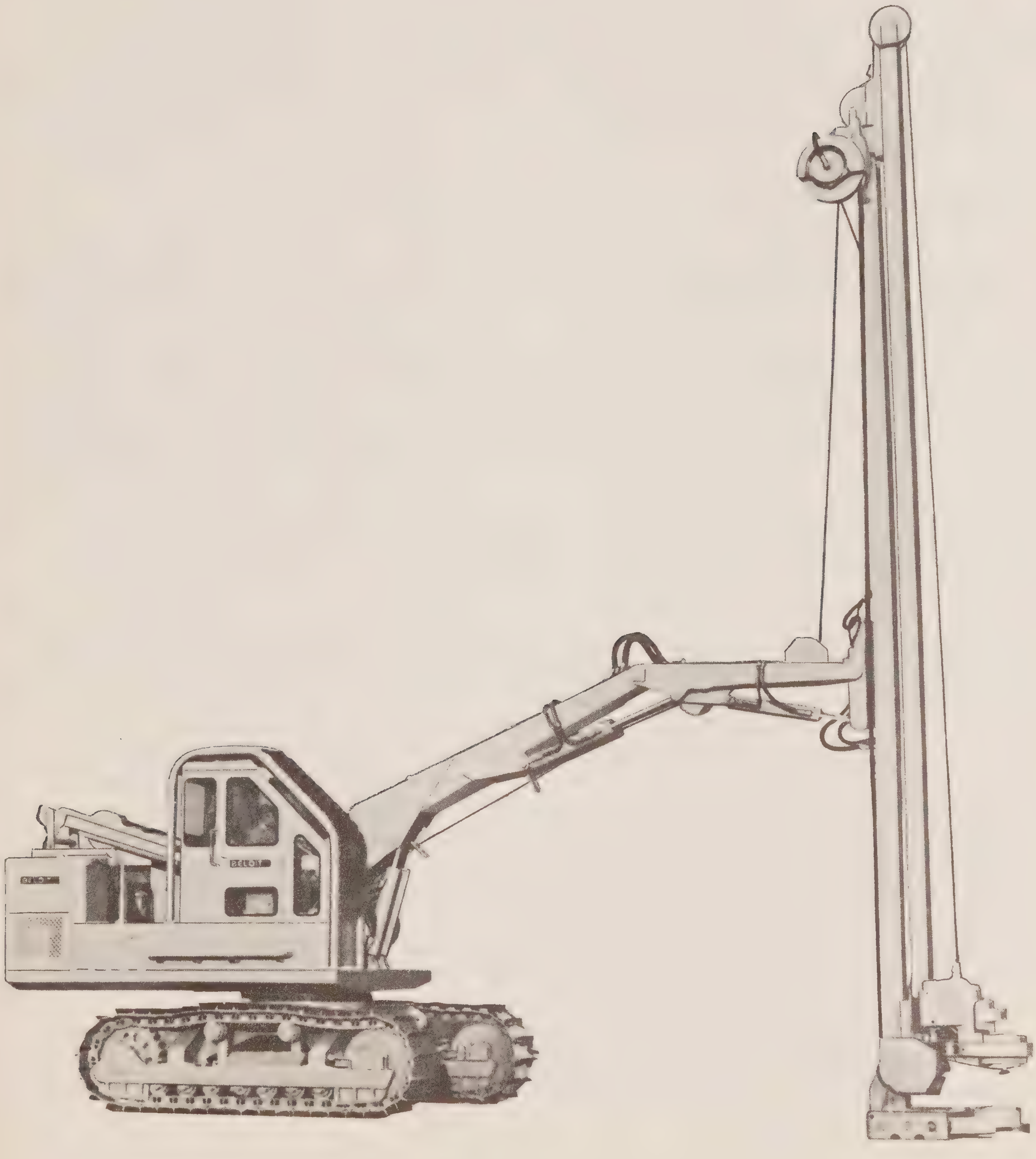
Nevertheless, the adoption of the skidder is only a partial step toward a fully mechanized system. The three possible paths to full mechanization envisaged by the Canadian Pulp and Paper Association (1950) were the short-wood, tree-length and full-tree systems.

<u>The short-wood system</u> is designed to process the tree as completely as possible at the stump, put it in a form acceptable to the mill and start it on its way in a more or less continuous flow. The system proposes to use two machines: a "full processor" designed for operation along the face of the stand to fell, limb, top, measure, buck and assemble bolts; and a "forwarder" to pick up the assembled bolts, forward them to roadside and load them on trucks.

A forwarder has been developed and is operational, with about 200 units in use. A processor designed in Canada has encountered development problems, and its future looks doubtful. However, an American machine - the Busch Combine - has been redesigned for Canadian conditions and a few are now on trial, including one in New Brunswick.

FIGURE 1-6

BELOIT HARVESTER
(DELIMBER AT BOTTOM POSITION).



The tree-length system makes use of the merchantable bole of the tree as a unit of production, prepares it at the stump and, using a skidder, takes it out to the truck road. The Beloit Harvester (Figure 1-6) works along the face of a stand, limbs and tops the standing tree, then shears it off at the stump and directs its fall into a rough pile. There are about 20 of these machines in use in Canada - including one each in Nova Scotia and New Brunswick.

The tree-length system has some definite advantages, provided the trees available are large enough to make an economical handling unit. Certainly in its ultimate form, with full-length boles going directly into the mill in place of four- or eight-foot sections,1/ it represents the simplest, most direct logging method in Eastern Canada with the greatest saving in manpower.2/ However, it must be pointed out that the Beloit Harvester requires substantial redesign and refinement before it can be considered a reliable production machine. Several other harvesters capable of producing full-length boles are in advanced stages of engineering.

The full-tree system is a new concept in timber harvesting. It is based on the idea that processing can be carried out most efficiently on a landing along a road rather than at the stump, particularly in the rather rough terrain of the Canadian Shield. A highly mobile, articulated wheeled skidder fells the trees, loads them on its chassis and takes them to the roadside where they are deposited. The processor, a self-propelled but slow-moving tracked or wheeled machine, moves along the truck road, picks up and feeds individual "full" trees into its processing assembly. The degree of processing depends on the circumstances and plan of operation. The machine normally will limb the trees, remove the bark,3/ and cut the bole into eight-foot lengths in a shearing action and deposit the bolts in a more or less continuous pile along the road at an estimated rate of about 6.5 cunits per hour.

Canadian developers of full-tree systems have reached the production stage after two years of field tests. Some imported systems are also now on trial or in use - a few in the Atlantic Provinces.

It is clear that the direction of technology in the forests of Eastern Canada is toward fully mechanized tree-harvesting systems. The development of machines and machine systems is visibly accelerating, and some are undergoing adaptation for use in less-than-maximum-scale harvesting operations. It is true that the forest is a biological complex of great variability which places severe demands on a mechanical system. Probably no one system will be able to cope successfully with all of the sets of conditions to be found in Canada. Nevertheless, there can be little doubt that timber harvesting methods will change rapidly in the years ahead.

1/ Nova Scotia Pulp Ltd. is one of two mills in Eastern Canada now equipped with a tree-length intake platform and conveyor system. Tree-length boles go through a Beloit Debarker directly into the chipper.

2/ There is one disadvantage - the trucking of tree-length boles presents some difficulties.

3/ The machine can be provided with or without a debarker.

Diffusion of Wood Harvesting Technology

Skidders

Skidders have come into very general use in Eastern Canada in the last few years (see Figure 1-7). In fact their use has spread through much of the world, and Canada has been the fountainhead from which this innovation has spread. Five firms manufacture skidders in Canada and 13 in the United States.

In 1967 there were about 4,800 skidders in Eastern Canada and 3,000 in the United States (Altman, 1966). In both counties the numbers are expected to increase rapidly. In the Atlantic Region there are about 780,1/ distributed as follows: New Brunswick 330, Nova Scotia 200, and Newfoundland 250.

Since these provinces use 16 per cent of the skidders and produce 22 per cent of the Eastern Canadian output of wood, it appears that the use of horses tends to be more prominent in this region. This is due largely to the wage differential between the regions and the high proportion of the cut which comes from small holdings in New Brunswick and Nova Scotia.

Skidders range in price from about $12,000 to $16,000, a capital investment which appears to be justified by the higher level of output. Small operators are, in general, unable to afford an investment of this size, and in many cases their scale of operations is too small even in physical terms to warrant use of a skidder.

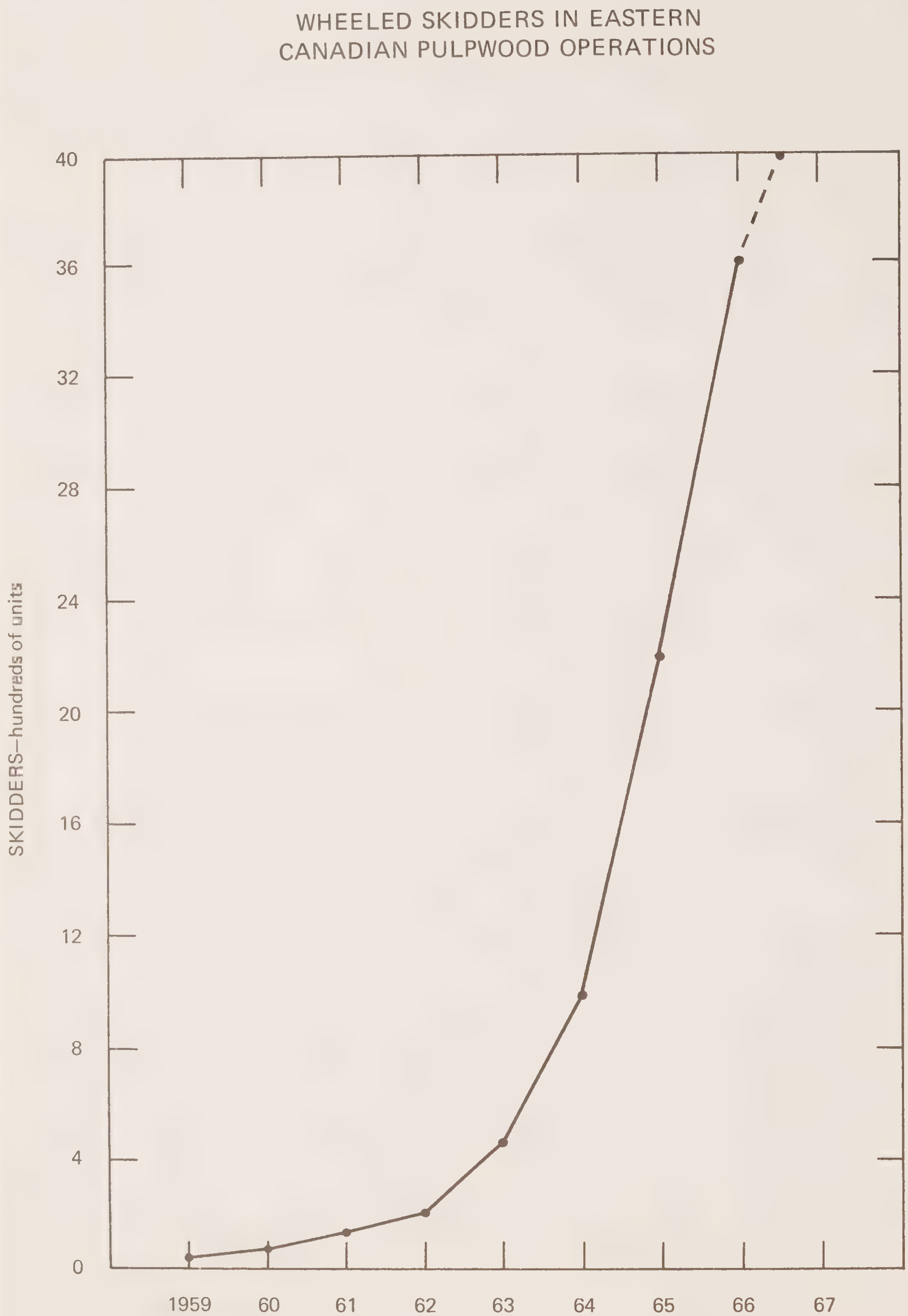
The lumber industry, which also is characterized by a large number of small units, is not in as good a position as the pulp industry to bring in this innovation. While it is difficult to say what proportion of the Atlantic skidder population is being used for pulpwood and sawlogs respectively (a great many are being used in combined operations), the information available suggests that the rate of diffusion in the pulpwood industry has been about twice as rapid as in sawlog production. Given the smaller number and greater financial capability of pulp mills relative to sawmills this is not surprising. More recently, however, there has been an increased interest on the part of sawlog producers.

Even in pulpwood production on the larger pulp company holdings (both leased and freehold) we find a very unequal application of skidders, ranging from none in the case of a couple of the smaller companies to close to 100 per cent in the case of four larger ones. These differences may be due in part to differing attitudes among managements and greater or lesser acceptance on the part of labour groups. On the whole, about 40 per cent of all pulpwood produced in New Brunswick and Nova Scotia is extracted or prehauled2/ by skidders now. There is no doubt that this proportion will increase, but there is also evidence that the rate of increase will be less in the future. In fact, sales have recently fallen off. The reasons are varied.

1/ From a survey by Seheult in 1965, adjusted to 1967.

2/ "Prehaul" is a term adopted by the woods industry to denote the primary, off-road transportation from the stump to a road.

FIGURE 1-7



Source: Silversides (1967)

First, although it is generally acknowledged that greater man-day productivity has been achieved by the use of skidders, it is by no means agreed that costs have gone down as a result. One New Brunswick company which is particularly successful thus far in its skidder program reports a doubling in man-day productivity and a substantial cost benefit. Others, although using skidders for very substantial portions of their cut, state quite definitely that "horse-produced" wood is still considerably cheaper to produce; but, of course, horses are rare and difficult to obtain. A large company which uses only skidders or somewhat similar types of equipment reports "horse-produced" and "skidder-produced" wood to be about equal in cost; however the latter makes possible a substantial saving through more uniform production scheduling, through a greatly improved wood inventory position at the mill and through reduced road-building costs resulting from wider spacing.

It appears, therefore, that where manpower is not critical and horses are available the conventional method will be in use for some time yet. Labour shortages or an increase in wage rates, however, will tend to favour more rapid adoption of new machines.

There are, however, other important reasons why the skidder has had a mixed reception. In the field investigation for this project it was found that skidder production varied a great deal. In the extreme it ranged from 13 cords to 22 cords per machine-day, representing a 70-per-cent difference. It is true that conditions of timber and terrain, especially the size of trees and the nature of the footing, have a considerable influence on production, yet these factors do not appear to explain all of the large difference noted. The balance is probably due to differences in the skill and training of operators and to lack of standardization of method.

In a large-scale test of skidder production carried out by the Pulp and Paper Research Institute of Canada, in which nine companies co-operated, it was found that, whereas the physical factors noted had important influences on production, the human factor outweighed them all (Bennet and others, 1965). This indicates that poor results are due to lack of training and proper operator selection throughout a wide segment of the industry.

Other circumstances point to the same conclusion. Resistance to the use of the machine, although not common, has been reported in the Atlantic Region. Also, the use of skidders has been quite unsuccessful in at least a few cases. The rapid introduction of skidders has given little time for many operators to gain experience, and the method itself has not been studied sufficiently yet to standardize practice. There is little doubt that skidder productivity can be increased considerably. One expert suggests the present average output of 1,500 cords per year can probably be doubled (Silversides, 1967).

In sawlog production there are other reasons why many operators are not using skidders in spite of the fact that these machines should offer them even greater advantages. Although the practice is declining, some sawlog producers use a type of selective logging in which they remove only the larger merchantable trees, leaving the small ones for future use. Where this is done, horse skidding has advantages because it is generally less destructive than mechanical skidding.

There is a great deal of confusion concerning the best management procedures for sawlog production and also a lack of knowledge of how to adapt skidders to a partial cutting situation. It is noteworthy that in British Columbia and in Sweden skidders are used quite successfully in this type of operation. The direction of research effort into sawlog production management and the adaptation of skidders to sawlog production under Canadian conditions is urgently needed.

Tree size is an important factor in skidder production. In some parts of New Brunswick, Nova Scotia, and Newfoundland where the timber is small, say $6\frac{1}{2}$" d.b.h. or smaller, tree size places a severe limitation on production by the tree-length method because of the length of time required to assemble a load. To overcome this, skidders have been adapted to an unusual method. The wood is cut into 8' lengths and stump-piled in the usual way and the bundles are picked up and carried crosswise under the fairlead. While effective from the point of view of skidder production (25 cords per shift is not unusual), it remains a labour-intensive method and one which eventually will be incorporated into the mechanization of the short-wood system to which it properly belongs.

Fully Mechanized Systems

The rate of introduction of fully mechanized logging systems will depend primarily on:

1) The time required to bring the new systems to a fully operational state.

2) The trend in manpower availability. During 1966, for example, the shortage in manpower forced several companies to accelerate their mechanization programs, whereas the ready availability of labour in 1967-68 tended to slow down the adoption of new techniques.

3) The cost advantages the new systems can offer.

It is estimated that approximately 40 multi-process logging systems were in operation in Canada in 1967.

Campbell and Power (1966), in their excellent study of technological changes in the logging industry and their manpower implications, made two estimates of the probable rate of diffusion of the Beloit Harvester and the Arbomatik Processor by 1970 and 1975. One of these (the differences between the two are not significant here) is reproduced in Table 1-47. In light of more recent progress, particularly in applications of the Beloit Harvester, these estimates would seem now to be conservative.

By 1970 there may possibly be two or three other machine systems competing with those discussed. To estimate the extent to which any of these systems will be used in the Atlantic Region is difficult. The Atlantic Region probably will not adopt them as fast as Ontario and Quebec unless wage scales and manpower situations change more rapidly than expected. However, the pulp and paper industry in this region will be able to use them as soon as it becomes economically advantageous to do so.

TABLE 1-47

Arbomatik Processor and Tree Harvester - Extent of Diffusion, Number of Machines, and Machine Pulpwood Production on Company Limit Operations, Eastern Canada and Provinces, 1970 and 1975[1/]

Province	Arbomatik Processor						Tree Harvester					
	1970			1975			1970			1975		
	Extent of Diffusion	Number of Machines	Machine Production	Extent of Diffusion	Number of Machines	Machine Production	Extent of Diffusion	Number of Machines	Machine Production	Extent of Diffusion	Number of Machines	Machine Production
	%	no.	000,000 cunits	%	no.	000,000 cunits	%	no.	000,000 cunits	%	no.	000,000 cunits
Eastern Canada	20	71	1.66	65	227	6.12	7	36	0.55	18	92	1.69
Ontario	13	15	0.35	52	56	1.51	15	26	0.39	38	60	1.10
Quebec	25	43	1.01	71	118	3.19	3	7	0.11	9	22	0.41
Atlantic[2/]	16	13	0.30	71	53	1.42	3	3	0.05	9	10	0.18

1/ Modified Gordon Commission output estimates.

2/ Includes Newfoundland and New Brunswick.

Source: Reproduced from Campbell and Power (1966).

Implications of New Technology for the Atlantic Forest Industry

Although it is difficult to project accurately the rate of diffusion of fully mechanized wood harvesting systems in the Atlantic Provinces, the process of mechanization is already underway. As it proceeds, it will have profound implications (1) for the size, composition, training requirements and pay scales of the labour force and (2) for the capital structure and organization of the industry. It will as well place new demands on the quality of forest management at every level. In this section recent trends in these aspects of woods operations are described and implications of changing technology discussed.

Changes in Productivity

Although there are several published statements on productivity and its changes, it is often difficult to reconcile these statements because there is no standard method of measuring productivity in logging and most of the statements refer to partial effects, i.e., changes in a part of the operation without reference to the whole.

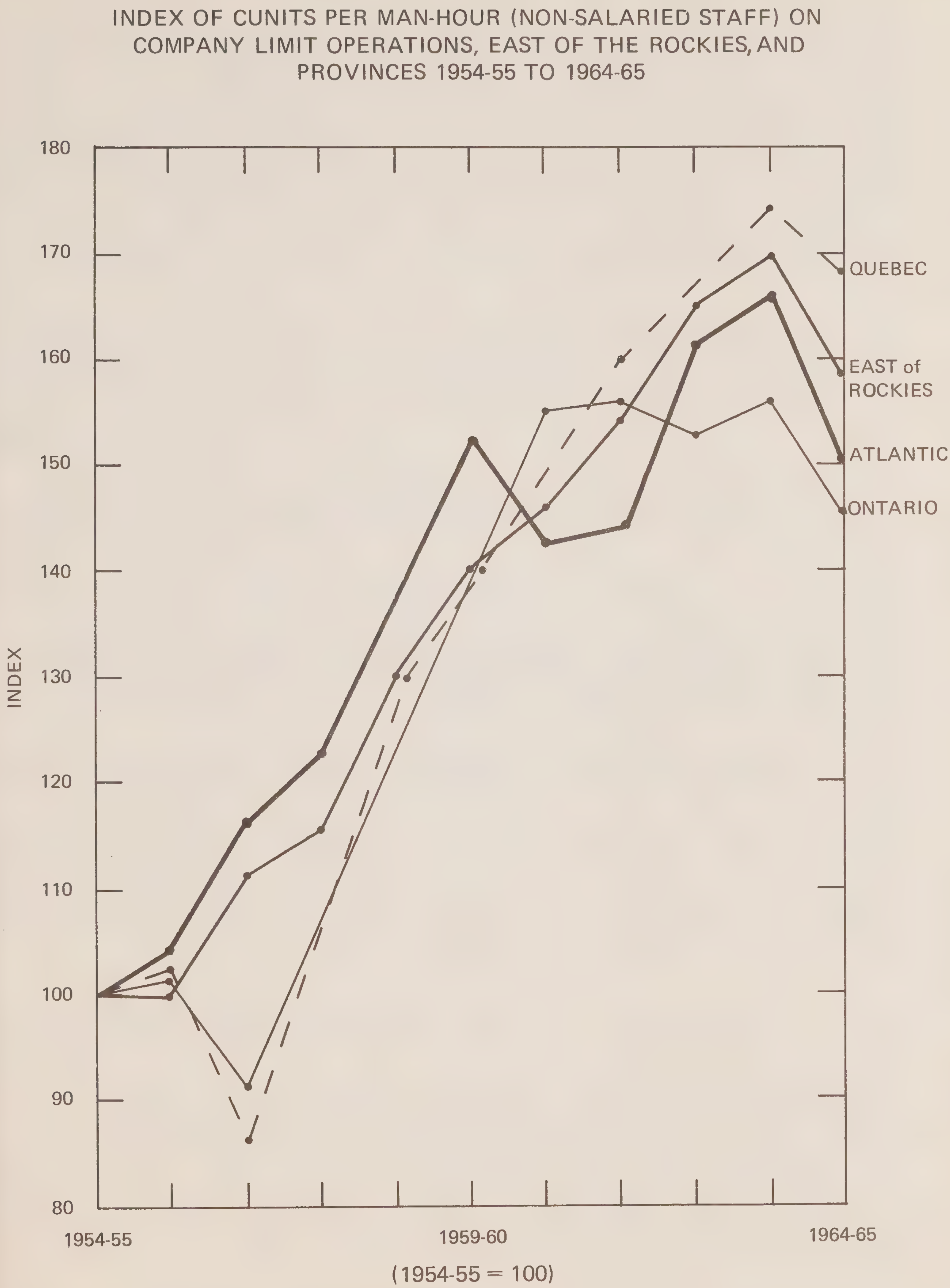
For pulpwood production, the most complete statement is by Campbell and Power (1966) showing an overall productivity gain for non-salaried staff on "limit operations" of 50 per cent from 1955 to 1965 in the Atlantic Region. This is equivalent to an annual rate of 4 per cent (Figure 1-8). However, even here the authors very carefully qualify the information given and are at a loss to explain the abrupt drop shown for 1964-65. This drop, if indeed one occurred, is indicated for a time when mechanization was proceeding rapidly. Information received from the companies concerned does not support any decline.

Increase in productivity in pulpwood logging in Nova Scotia and New Brunswick stems from two sources, technological change and labour training. Starting about 1950, the rapidly growing use of power saws improved productivity in cutting operations by 30 per cent. Since 1960 the chain saw has achieved further gains through weight reduction and greater reliability. More recently skidders and more efficient loaders, already described, have contributed their share.

During the 1950's, some pulp and paper companies in the region conducted very vigorous on-the-job training programs, especially in cutting practice. One company recorded a 7-per-cent annual rate of growth in productivity between 1961 and 1966 and considers this to be due largely to on-the-job training and a general "tightening up" in the whole organization.

The objective in the new mechanization systems now under development is an increase in productivity of the order of 300 or 400 per cent. However, between introduction of a new system and achievement of stability there is usually a difficult period characterized by low productivity and high costs. One can therefore anticipate a continuing annual growth of man-day productivity in the next few years of about 4 or 5 per cent, followed by a more rapid rise as the new systems become stabilized in the Atlantic Region.

FIGURE 1-8



Reproduced from: Campbell and Power (1966)

In sawlog operations, it is even more difficult to get a reliable estimate of changes in productivity because there is no recorded information. Sawlog operators attribute a substantial gain in productivity to the introduction and use of the chain saw. As in the case of pulpwood, further gains have come from the use of skidders, better loading devices and so on. Producers' estimates of total productivity gains in these phases of the operation vary from a low of 50 per cent to a high of 100 per cent over the last 20 years. These, however, are casual estimates and rely heavily on subjective judgements. Unfortunately, there is not the same bright prospect ahead for increased productivity except in combined operations for logs and pulpwood, or in other special circumstances. The development or adaptation of new machines specifically for sawlog production is, of course, a possibility, but one which has not been given much consideration in Eastern Canada so far.

Woodlot production, which accounts for a significant part of the cut in Nova Scotia and a somewhat smaller but still important part in New Brunswick, presents an even more difficult problem in productivity measurement.

It may be useful to break woodlot owners into three groups. First, those woodlot owners who are good loggers, good managers and efficient producers undoubtedly take advantage of techniques appropriate to the sizes of their operations. Second, there are absentee owners and older people (probably about 20 per cent of the total in New Brunswick) whose wood is cut by itinerant "professional" loggers. Both of these groups of owners are reasonably progressive and some gains in productivity on their operations can be assumed. On woodlots owned by the third group, however, a large amount of pulpwood is cut on a part-time basis by persons who are untrained in any way, and - although information is lacking - progress in productivity for this group seems doubtful.

The basic problem is well known. The size and condition of most woodlots and their shifting ownership are such that in general they do not consitute economic units; as a result, the woodlots and their owners tend to be locked into reciprocal states of mismanagement and poverty. In general, they have fallen outside the orbit of progress and have little force in the market place. In contrast, the woodlot owners in Quebec, with supporting legislation,1/ have been able to secure much higher prices for their wood - about 25 to 35 per cent higher than the prices prevailing prior to the establishment of marketing associations.

There are Forest Extension Services in both New Brunswick and Nova Scotia, but they have not been supported adequately and probably cannot cope with such a deep-seated problem. This view is reinforced by the fact that there is no adequate or convincing policy in either province which defines the desirable objectives and the means of achieving them. The result is a multiplicity of forces acting on the situation, some federal, some provincial, some originating within the group of woodlot owners - but none of them effective. As a result progress is slow, perhaps too slow for the forces which are overtaking uneconomic woodlots: the inability to achieve adequate gains in productivity to keep competitive and to prevent the transfer of ownership to large corporations.

1/ Pulpwood producers' marketing associations have been established under the Quebec Agricultural Marketing Act, c. 34, Statutes of Quebec, 1963.

Size of Labour Force

Statistics on the woods labour force in the Atlantic Provinces have been poor in the past. For example, until recently no information was collected on the logging industry in Nova Scotia. However, recent statistics published by D.B.S. permit us to identify the logging industry in the Atlantic Provinces more exactly for the years 1963, 1964 and 1965. The logging industry as defined by D.B.S. does not include logging operations conducted by sawmill establishments where separate records of their logging operations are not maintained, does not include farm woodlot operations, and does not include logging operations producing less than 60,000 cu. ft. per year. The effect of these exclusions is that production by the D.B.S.-defined portion of the logging industry in each province represents only a part of total primary wood production. The percentages of total provincial production in 1964 attributable to the industry as defined by D.B.S. were as follows: Newfoundland, 76 per cent; Prince Edward Island, nil per cent; Nova Scotia, 35 per cent; and New Brunswick, 69 per cent. For comparison the D.B.S.-defined logging industry in 1964 was estimated to be responsible for 93 per cent of the production in British Columbia, 61 per cent in Ontario and 63 per cent in Quebec.

Table 1-48 illustrates some of the interprovincial variations in output and earnings in the woods labour force.

TABLE 1-48

Output and Earnings of Logging Industry, 3-Year Average, 1963-65

Province	Shipments of Roundwood	Value of Shipments Per Cunit	Number of Production Workers	Average Hourly Earnings Per Worker	Average Yearly Earnings
	cunits	$	no.	$	$
Nfld.	799,394	33.78	2,822	1.71	4,168
N.S.	617,167	27.90	1,165	1.13	2,723
N.B.	1,958,432	26.89	3,979	1.49	3,612
Que.	7,677,539	30.95	19,670	1.70	4,145
Ont.	4,708,725	32.43	9,585	2.18	5,273
B.C.	14,230,382	37.47	15,946	3.00	5,757

Source: Logging, 1965. D.B.S.

Unfortunately it is not possible to calculate physical output per man in the logging industry for interprovincial comparison. The reason is that an unknown amount of wood is purchased directly by the industry, or obtained by sub-contracting. The variation in this practice from province to province can be seen in Table 1-49. It is apparent that the logging industry in Newfoundland purchases very little of its wood from other sectors, while the practice is very common in Nova Scotia and in other provinces. Similarly, British Columbia is outstanding in the amount of contract wood purchased by the logging industry, though the practice is common in the Atlantic Region, as well. This variation in provincial practice makes it impossible to compare physical productivity between provinces. It is possible, however, to compare interprovincial productivity in terms of value added (Table 1-50).

TABLE 1-49

Cost of Materials and Supplies Per Cunit of Roundwood, by Province, 1965

Province	Purchased Wood	Stumpage and Royalties	Supplies (excl. fuel)	Contract Wood	Total
	$	$	$	$	$
Nfld.	0.90	0.15	2.39	4.35	7.78
N.S.	9.24	0.79	1.76	5.15	16.43
N.B.	6.75	1.76	1.49	4.04	14.05
Que.	4.65	2.24	2.94	2.92	14.93
Ont.	5.84	2.47	2.90	2.94	14.13
B.C.	6.32	2.37	3.00	10.13	21.84

Source: Logging, 1965. D.B.S.

TABLE 1-50

Value Added in Logging Industry - 3-Year Average 1963-65

Province	Total Value Added	Value Added Per Production Worker	Value Added Per Man-Hour Paid	Value Added Per Dollar Wages
	$ 000	$	$	$
Nfld.	18,488	6,551	2.69	1.57
N.S.	6,617	5,678	2.35	2.08
N.B.	24,957	6,272	2.59	1.74
Que.	118,861	6,043	2.49	1.46
Ont.	80,198	8,367	3.45	1.59
B.C.	223,718	14,029	7.31	2.34

Source: Logging, 1965. D.B.S.

In terms of value added per worker or per man-hour, British Columbia, Ontario and Newfoundland lead the other provinces, with Nova Scotia trailing. In terms of value added per dollar of wages, British Columbia still ranks first, but is followed by Nova Scotia and New Brunswick, with Quebec trailing.

Part of the explanation for the low value added per man in Nova Scotia and New Brunswick is the low value of shipments per cunit (see Table 1-48), which results in low-cost wood inputs to the secondary wood-processing industry.

In British Columbia the high value of shipments per cunit is due to the inherent high quality of the resource in the coastal industry, producing high-value veneer and sawlogs, poles and pilings.

Occupational Structure of the Woods Labour Force

Table 1-51 shows the occupational structure in pulpwood logging in Newfoundland and New Brunswick, or at least that part of production which comes under the direct or indirect control of the pulp and paper companies. It can reasonably be assumed that the pattern also applies to Nova Scotia but not, of course, the number of employees.

However, there is no information about that portion of the cut which comes from woodlots. It is safe to assume that there is less specialization on woodlots and that several functions such as cutting, roadmaking, and possibly skidding might at various times be done by the same man. In any event the cutting function would predominate. Trucking is usually done by an independent trucker.

A number of shifts in the composition of the labour force are revealed in Table 1-51. The percentage of cutters between 1956 and 1965 shows the greatest change because of the increasing efficiency of chain saws and probably, more experience and training. Mechanics and machine operators have increased in importance, but the proportion of teamsters has decreased by half. The category "unspecified occupations" is a catchall and difficult to analyse, but it does include skidder operators, trainees, etc.

Table 1-52, prepared by Campbell and Power for Eastern Canada, is included here because it gives an estimate of the changes in structure which can be expected. Its main feature is the sharp reduction in the proportion of cutters and a rise in the proportions of mechanics and machine operators.

In the production of sawlogs, the same general skills are employed as in pulpwood operations with, however, not as high a proportion of cutters and a relatively greater proportion of teamsters. Whereas we can expect a greater use of articulated skidders in sawlog production, the mechanization of sawlog production remains obscure - except where it is combined with the production of pulpwood.

TABLE 1-51

Occupational Structure of the Pulpwood Logging Industry in the Atlantic Provinces,1/ 1956-1965

Occupation	1956		1957		1958		1959		1960		1961		1962		1963		1964		1965	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
Total non-office employees..............	9,004	100.0	6,480	100.0	5,134	100.0	8,354	100.0	10,851	100.0	8,621	100.0	7,017	100.0	7,897	100.0	8,391	100.0	8,411	100.0
Production workers.....................	7,266	80.6	4,847	74.8	3,626	70.6	6,485	77.6	6,721	62.0	6,240	70.7	4,759	67.8	5,989	75.8	5,955	71.0	5,944	70.7
Pulpwood cutters 2/	5,747	63.8	3,757	58.0	2,629	51.2	5,249	62.9	5,624	51.8	5,034	57.0	3,646	52.0	4,940	62.6	4,352	51.9	4,442	52.8
Truck driver 3/	396	4.4	370	5.7	287	5.6	220	2.6	495	4.6	131	1.5	228	3.2	292	3.7	536	6.4	492	5.9
Log-truck driver......................	396	4.4	370	5.7	287	5.6	220	2.6	484	4.6	-	-	206	2.9	220	2.8	446	5.3	303	3.6
Heavy truck driver..................	-	-	-	-	-	-	-	-	1	-	113	1.3	10	0.1	53	0.7	59	0.7	173	2.1
Light truck driver..................	-	-	-	-	-	-	-	-	10	-	18	0.2	12	0.2	18	0.2	31	0.4	16	0.2
Tractor driver........................	92	1.0	67	1.0	79	1.5	77	0.9	138	1.3	158	1.8	232	3.3	232	2.9	306	3.6	269	3.2
Teamster..............................	472	5.2	285	4.4	300	5.9	736	8.8	180	1.7	300	3.4	163	2.3	67	0.8	258	3.1	222	2.6
Loader................................	33	0.4	23	0.4	43	0.8	21	0.3	24	0.2	68	0.8	110	1.6	140	1.8	147	1.8	140	1.7
Leader................................	268	3.0	149	2.3	163	3.2	103	1.2	121	1.1	357	4.0	296	4.2	264	3.3	281	3.3	283	3.4
Roadman and swamper...................	258	2.8	196	3.0	125	2.4	79	0.9	139	1.3	187	2.1	81	1.2	51	0.6	72	0.9	96	1.1
Labourer, production 4/	-	-	-	-	-	-	-	-	-	-	5	0.1	3	*	4	0.1	3	*	-	-
Maintenance and service personnel........	725	8.2	494	7.6	429	8.4	606	7.3	748	6.9	977	11.1	762	10.9	713	9.0	690	8.2	743	8.8
Cook, cookee and choreboy.............	475	5.4	286	4.4	268	5.3	389	4.7	387	3.6	409	4.6	242	3.4	310	3.9	354	4.2	331	3.9
Mechanic..............................	41	0.5	10	0.2	26	0.5	29	0.3	35	0.3	41	0.5	25	0.4	28	0.4	43	0.5	73	0.9
Labourer, non-production 4/	-	-	-	-	-	-	-	-	155	1.4	375	4.3	418	6.0	319	4.0	225	2.7	276	3.3
Other maintenance and service personnel 5/	209	2.3	198	3.0	135	2.6	188	2.3	171	1.6	152	1.7	77	1.1	56	0.7	68	0.8	63	0.7
Unspecified occupations 6/	1,013	11.2	1,139	17.6	1,079	21.0	1,263	15.1	3,382	31.1	1,604	18.2	1,496	21.3	1,195	15.1	1,746	20.8	1,724	20.5

* Less than 0.05 per cent.

NOTE: Percentage figures may not add up to 100.0 because of rounding.

1/ Includes Newfoundland and New Brunswick.

2/ Includes chopper and cutter.

3/ From 1956 to 1959 only "Log-truck driver" was requested. In 1961 "Log-truck driver" was reported as "Heavy-truck driver".

4/ From 1956 to 1959 labourers were not requested. In 1960 "General labourer" was asked for and is shown under non-production labourers. From 1961 to 1965, however, a breakdown by production and non-production was available and is shown as such in the table. Watchman and cleaner have been included with non-production labourers.

5/ Includes blacksmith, carpenter, electrician, handyman, machinist, sawfiler and welder.

6/ From 1960 to 1965 this residual category includes probationary, temporary and part-time employees, learner, apprentice, beginner and trainee. In addition, for all years, the following are included: supervisory personnel, female employees, mechanical pulp harvester operator, skidder operator (some, however, are taken into account under "Tractor driver"), power trucker and grader operator.

Source: Canada Dept. of Labour, Economics and Research Branch, Returns to the Wage Rates, Salaries and Hours of Labour Survey, 1956-1965. Reproduced from Campbell and Power, (1966), Table A-2.

TABLE 1-52

Autumn Occupational Distribution in the Pulpwood Logging Industry In Eastern Canada - Average, 1964 and 1965 - Forecast, 1970 and 1975 1/

Occupation	Average 1964 and 1965		1970		1975	
	no.	%	no.	%	no.	%
Total non-office employees	32,042	100.00	27,912	100.0	19,080	100.0
Production workers	22,974	71.70	19,049	68.3	10,766	56.4
Arbomatik processor operator	-	-	283	1.0	909	4.8
Harvester operator	-	-	71	0.3	183	1.0
Pulpwood cutter	17,233	53.78	13,627	48.8	4,298	22.5
Truck driver	1,426	4.45	2,038	7.3	2,328	12.2
Skidder and tractor operator	1,564	4.88	1,537	5.5	1.505	7.9
Teamster	645	2.01	63	0.2	-	-
Scaler	584	1.82	686	2.5	777	4.1
Loader	511	1.59	536	1.9	607	3.2
Roadman and swamper	694	2.17	101	0.4	61	0.3
Labourer, production	317	0.99	107	0.4	97	0.5
Maintenance and service personnel	3,011	9.40	3,250	11.6	3,272	17.2
Cook, cookee and choreboy	1,388	4.33	1,221	4.4	867	4.5
Mechanic	465	1.45	964	3.5	1,373	7.2
Labourer, non-production	700	2.18	582	2.1	486	2.5
Other maintenance and service personnel	458	1.43	483	1.7	547	2.9
Unspecified occupations	6,057	18.90	5,613	20.1	5,041	26.4

1/ Modified Gordon Commission output forecast.

Source: Reproduced from: Campbell and Power (1966).

Rates of Pay and Incomes

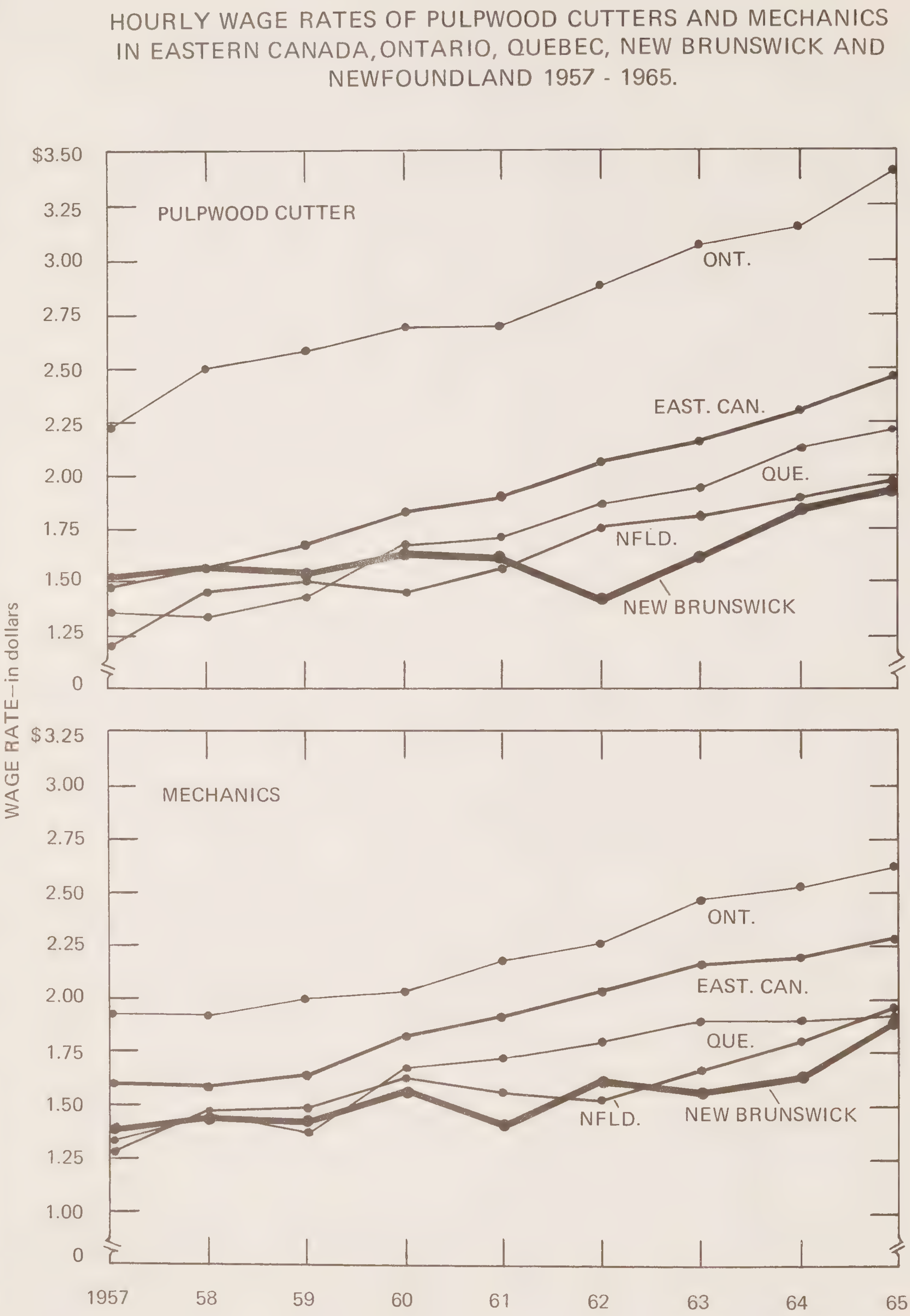
The 1964 report of the Economics and Research Branch of the Department of Labour gives a table of indices of average wage rates for all industries, based on 1949 = 100. It shows that wage rates in logging in Eastern Canada have risen relatively more than in most other categories (including logging in British Columbia). This rise, at an index of 222.6, indicates an annual growth rate of 5.5 per cent which is above the apparent rate of productivity increase for the period. It was surpassed only in cigarette manufacturing, brewing, and construction.

The increase, however, has not been uniform in all parts of Eastern Canada. Figure 1-9 compares the trends in wages for Ontario, Quebec, Newfoundland, and New Brunswick for two categories of woods workers, pulpwood cutters and mechanics. New Brunswick shows the lowest wage levels. There is also probably more variation in wage levels in New Brunswick and Nova Scotia than in Newfoundland, Ontario and Quebec.

The striking fact is that in the case of the cutters, the most significant category of woods workers, the spread between Ontario and the rest of Eastern Canada has been increasing. This is an unstable situation which is unlikely to continue.

A wage agreement for pulpwood operations in Ontario was signed in December, 1966. It was a joint negotiation, that is, seven pulp and paper companies joined to negotiate with the union. A gain in wages and benefits totalling about 8 per cent was achieved. In Table 1-53 a comparison is made with New Brunswick for a few categories.

FIGURE 1-9



Reproduced from: Campbell and Power (1966)

TABLE 1-53

Comparison of Wage Rates in Logging Operations, Ontario and New Brunswick, 1967

Classification	Ontario	New Brunswick
	$	$
Basic Labour Rate	2.33 per hour	1.32 per hour
Cook	22.57 per day	14.75 per day
Tractor Operator (Heavy)	2.93 per hour	1.64 per hour
Truck Driver	2.58 - 2.91 per hour	1.48 per hour
Operator, Beloit Harvester	3.22 per hour	---- --- ----
Cutter (Spruce, Fir), 4' (rough)	9.69 per cord1/	6.05 - 7.60 per cord

1/ In addition there is a bonus of 82 cents per cord after 75 cords.

Average hourly earnings per worker, when translated to an index with Ontario as 100, show considerable provincial variation (Table 1-54).

TABLE 1-54

Index of Average Hourly Earnings Per Production Worker, 3-Year Average, 1963-65

Province	Index1/
Newfoundland	78.4
Nova Scotia	51.8
New Brunswick	68.4
Quebec	77.9
Ontario	100.0
British Columbia	137.6

1/ Base Ontario = 100.

Source: Derived from Table 1-48.

The upper level of rates for sawlog cutters in New Brunswick is set by union agreement with those pulp and paper companies which also produce sawlogs. These rates in 1967 were \$13.50 to \$14.00 per 1,000 f.b.m. with 50 cents extra per 1,000 f.b.m. where employees commute. One company paid \$15.00 for hardwood. Small operators (and some which were not so small) paid lesser rates, often \$12.00, but in one instance as low as \$9.00 per 1,000 f.b.m.

The individual income derived from logging employment varies a great deal depending largely on the number of days worked and on the category of work. Pieceworkers (cutters) are the highest earners.

Labour Organizations

There are no labour unions in woods operations in Nova Scotia but there have been some recent attempts to organize workers on some of the larger pulpwood operations.

In New Brunswick unionism in pulpwood operations had a successful start several years ago, and at the present time woods employees of four pulp and paper companies are organized under locals of the Brotherhood of Carpenters and Joiners of America. Two of these companies are also engaged in sawmilling and the union agreements also cover the production of sawlogs. It is reported that these locals have a total membership of 2,600 men. There are no other woods unions in New Brunswick.

The International Woodworkers of America (IWA) was certified as bargaining agent for woods employees of the two Newfoundland pulpmills and led a strike there in 1959. The provincial government passed emergency legislation decertifying the IWA in March of that year and installed a substitute union, the Newfoundland Brotherhood of Woods-Workers. Subsequently the NBWW affiliated with the Brotherhood of Carpenters and Joiners of America which is now recognized as bargaining agent for woods employees by the two pulpmills.

As the supply of cheap labour declines in the Atlantic Region; as mechanized systems become more general and the proportion of skilled workers rises; as the number of firms declines and the scale of operation increases to take advantage of mechanized systems - the organization of labour in the forest industries is sure to follow. If the experience of Ontario is a guide, this development could mean a more stable and disciplined labour force. Ontario's turnover rate is much lower, a fact attributed in large part to union discipline.

Education and Training

Loggers have the lowest educational level of all major census groups. In New Brunswick 87 per cent of the woods labour force has less than Grade 9, and 25 per cent has less than Grade 5. There is a relatively high proportion of functional illiterates. New Brunswick and Newfoundland are probably the worst in this respect but the situation holds generally throughout Eastern Canada. This is especially unfortunate because the average age of loggers is some five years less than the average age of all workers.

More education is the first and most basic need in upgrading the level of capability and skills of the woods labour force. In New Brunswick several on-the-job training courses have been given in the last two years to train and upgrade skidder operators for pulpwood operations. Some pulp and paper companies have asked for and co-operated in these efforts and the results are reported to be good. More recently, a course in heavy equipment operation has been given at Edmundston. There have been no similar programs in Nova Scotia. This may be due in part to the more extensive use of the "contractor" system - a view supported by the fact that in New Brunswick those companies using the "contractor" system more or less exclusively also have not taken part in these programs.

Labour training in woods operations is not new in New Brunswick. Some of the pulp and paper companies have had their own programs for several years. This has not been the pattern in Nova Scotia.

The lack of training in forestry operations and woodlot management in the Atlantic Provinces stands in sharp contrast to the practice in such countries as Sweden where instruction and training in all aspects of forest work for all groups is the rule. Lumber and pulp company managements must shoulder a large share of the blame; too many company officers in charge of woods operations in the Atlantic Region are concerned too much with the immediate at the expense of longer-term development.

Because harvesting technology and techniques are changing rapidly it appears unwise for public programs to concentrate on training young men as pulpwood cutters, in spite of the fact that this is the category of worker most urgently in demand, because it seems likely that this occupation will soon be obsolete as a career. It therefore appears that the supply of cutters must be secured by the companies concerned through their own efforts. In the meantime the companies must turn as rapidly as possible to the newer techniques. As these newer techniques are mostly machine systems, the basic training for operators can take place within the framework of existing technical institutes, supplemented by on-the-job training for specific machines.

Seasonal Variations in Employment

Judging from pulpwood logging statistics, the seasonal peak in woods employment has not shifted very markedly over the period since 1952. Table 1-55 shows that the peak has most often been in October, and this continues to be the case in the 1960's. The data in Table 1-56 show that, although average winter employment has declined, it has continued to exceed average summer employment in most years since 1960. Summer employment in pulpwood logging has increased only in the relative sense: winter employment has declined considerably, while summer employment has declined much less.

The statistics on the forestry sector as a whole are far less complete than those on pulpwood logging. For the period 1953-56, monthly indexes of employment in forestry for Newfoundland and New Brunswick are available from D.B.S. unpublished data. For 1957-1965, actual employment figures are available for all four provinces. A study of these statistics

TABLE 1-55

Peak Employment in Pulpwood Logging, Atlantic Region, 1952-1964

Year	Month of Highest Employment	Average Number Employed
1952	February	9,556
1953	October	8,275
1954	October	9,056
1955	November	11,183
1956	October	10,547
1957	June	8,727
1958	June	6,745
1959	October	7,095
1960	October	8,144
1961	October	9,934
1962	January	5,715
1963	October	5,712
1964	July	6,286

Source: Campbell and Power (1966), Table B-4.

TABLE 1-56

Average Summer and Winter Employment in Pulpwood Logging,

Atlantic Provinces, 1952-1964

Year	Average Winter 1/ Employment	Average Summer 2/ Employment
1952	8,098	4,608
1953	6,602	5,678
1954	6,724	5,955
1955	8,118	6,148
1956	7,383	7,141
1957	5,072	5,968
1958	3,788	4,837
1959	4,167	4,250
1960	4,549	5,465
1961	5,395	3,170
1962	4,283	3,630
1963	3,869	3,550
1964	4,386	4,609

1/ Average for January, February, March and October, November, December.

2/ Average for April to September both inclusive.

Source: Campbell and Power (1966), Table B-4.

shows that over the 13-year period, taking woods employment as a whole, the autumn and summer seasons were the periods of highest employment. At no time were there indications of higher employment in the mid-winter months than in the mid-summer months. In view of the relatively high winter employment in pulpwood logging, this would imply a much greater concentration of sawtimber activity in the summer and fall months.

It is not clear to what extent winter employment declined from 1953 to 1965. However, the latest statistics do show that in the 1960's March and April constituted the period of lowest employment and that January, February and May usually ranked just above.

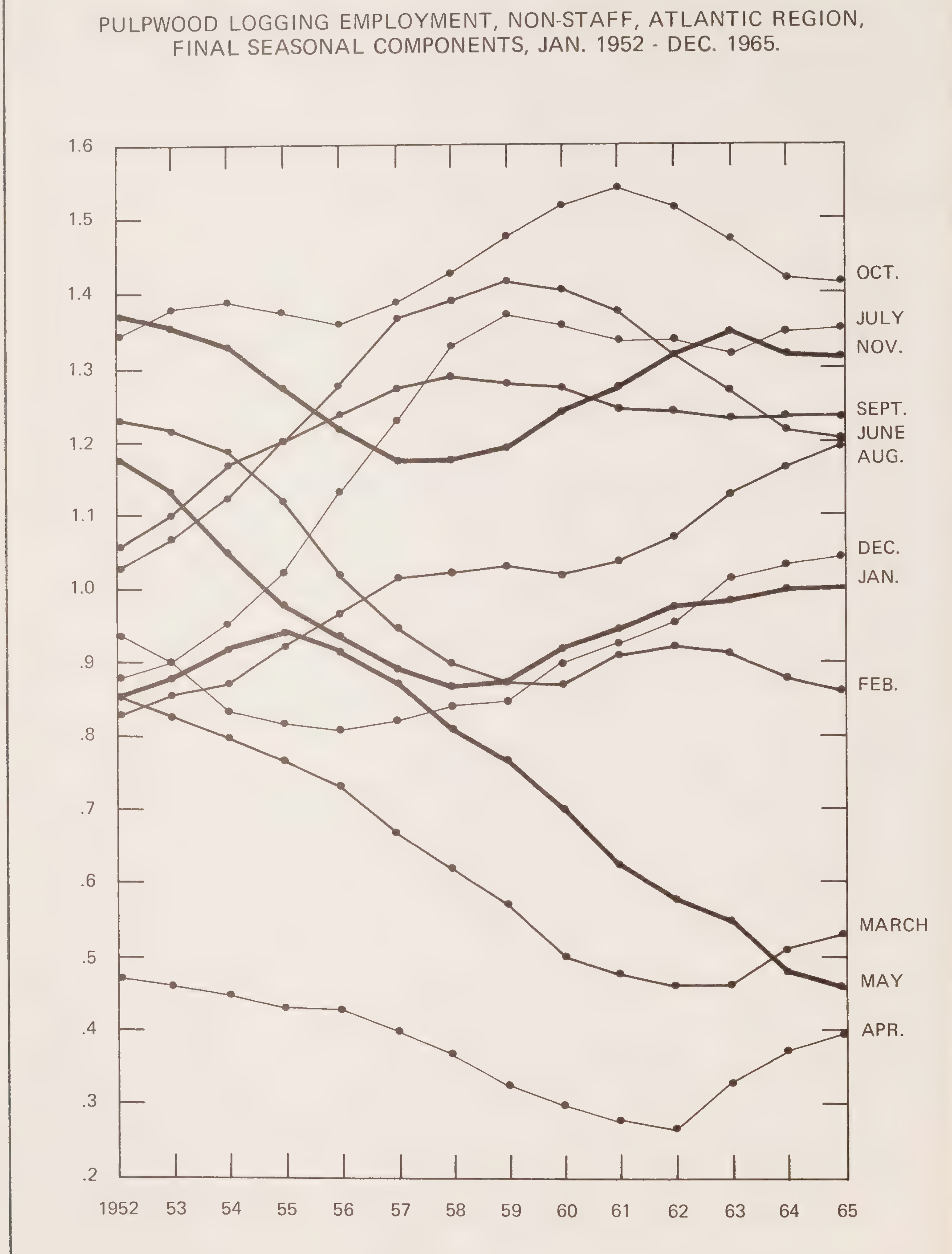
Examination of both the pulpwood logging industry and the logging industry as a whole in the Atlantic Provinces leads to the conclusion that a considerable shift in activity has occurred. The greatest decline has taken place in late winter and spring employment while summer and autumn employment has changed much less. October remains the peak employment month. Constant summer employment during a period of technological advance implies that summer output in real terms must have been increasing.

Campbell and Power (1966) examined the seasonal employment trends in pulpwood logging in the Atlantic Region by plotting the monthly divergences from the annual average over a series of years (Figure 1-10). Each line shows the employment coefficient for a particular month; for example, if employment were uniform all 12 lines would fall on the coefficient 1.0. The period 1952-1961 was generally one of increasing seasonal variation in employment, with seven months showing rather sharp swings up or down from the mean. Since 1961, however, there has been a tendency toward less seasonality, with eight months converging closer to the mean. Nevertheless, the range of variance in the Atlantic Region was still high in 1965 - from about 0.4 to 1.4.

Compare this situation with similar data for Ontario and the Prairies (Figure 1-11). In 1952 seasonal variations in the Ontario-Prairies areas were comparable to those in the Atlantic Provinces. However, the shift which took place over the following decade was much more consistent and well-defined in the Ontario-Prairies areas. In effect a 9- to 10-month season became clearly established. Since 1962, seasonal variations have become less pronounced, and by 1965 were considerably smaller in amplitude (0.5 to 1.2) than in the Atlantic Provinces.

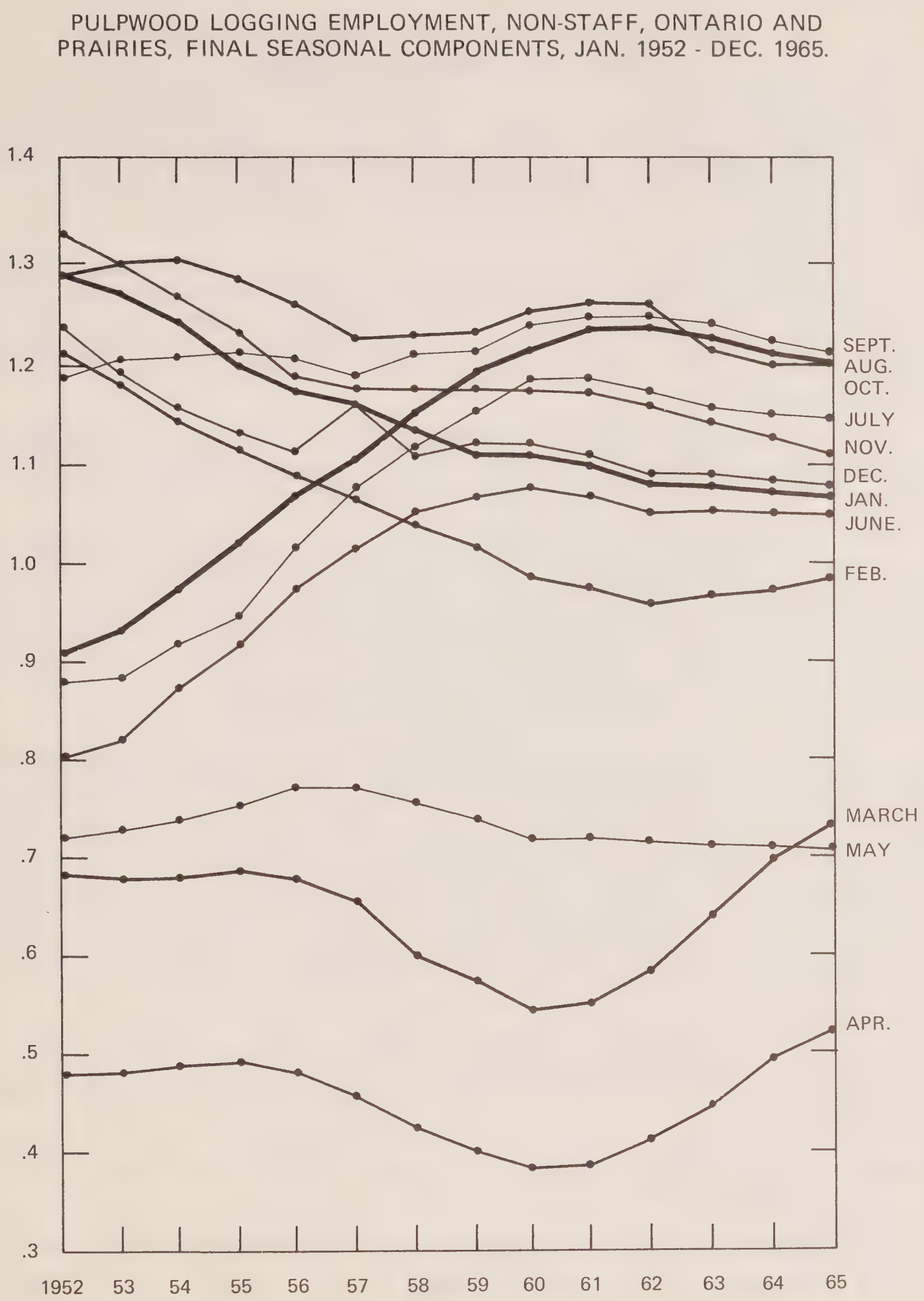
In summary, seasonal variations in woods employment in the Atlantic Region remain relatively high, although there has been some improvement in recent years. The Atlantic Region has made less progress than Ontario in working toward a 9- to 10-month work season. The impact of technology on the changing pattern is not altogether clear. To what extent is the relative stability of summer employment in a period of decline in total employment due to the greater efficiency of mechanized systems during the summer period? To what extent is the lack of access roads a factor in discouraging workers and employers from winter commuter work? What efforts had the industry in the Atlantic Region made to adapt mechanized systems to winter conditions? These are questions meriting further investigation.

FIGURE 1-10



Reproduced from: Campbell and Power (1966)

FIGURE 1-11



Reproduced from: Campbell and Power (1966)

Capital Structure and Investment

The organization of production on company holdings in the Atlantic Region, that is, the structure and control of the agents of production, entrepreneurship, labour and capital, presents a mixed picture. At one extreme "limit wood" (i.e., wood from the company's own holdings) is produced in an operation in which the company itself plans, organizes, provides equipment, secures labour, and carries out the operation which is at all times under its direct control. This is the practice in some cases in New Brunswick, especially in the more highly mechanized operations.

At the other extreme there are cases in which the company harvests its entire quote of "limit wood" through contractors and does not provide any equipment but simply makes the over-all plans and supervises the carrying ing out of the contract. This seems to be particularly the practice in Nova Scotia, although there are tendencies in this direction in New Brunswick and Newfoundland.

There are, of course, many intermediate cases, with the general tendency being for the company to carry out the more mechanized operations and for contractors to deal with more conventional ones.

In general, there is a trend in the Atlantic Region as a whole for a relatively large proportion of pulp and paper companies to avoid large capital outlays on timber-harvesting and transportation equipment, either by leasing (financial and maintenance leases) or by having the contractor purchase the machines. In most of these cases the companies in question are either relatively new or are involved in large-scale expansion. In both instances there is a need to conserve capital resources.

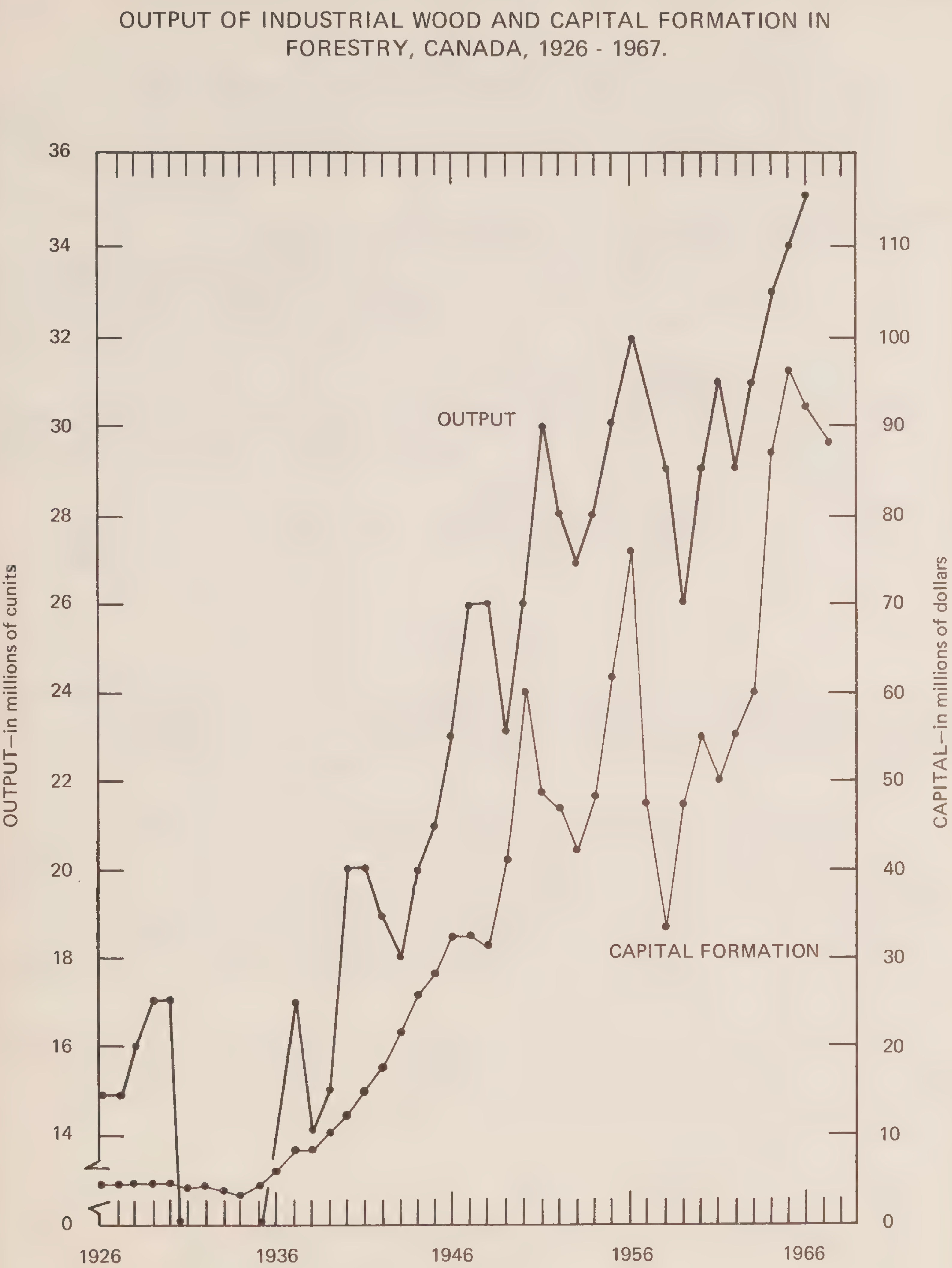
Figure 1-12 shows plots of capital formation in forestry and the output of industrial wood - for all of Canada. Due allowance being made for the irregularities in the plot of capital formation, the general trend in the two graphs is the same; one more or less parallels the other from 1946 to 1962. Since that time, however, there has been a sharp increase in the rate of capital investment. This trend will probably continue. Silversides (1967) estimates that it will require about $8 per cunit of production to introduce the new machine harvesting systems. This means an additional capital investment of the order of $100 million on this count alone, if and when it takes place.

With the increase of mechanization there has, of course, been a change in the cost structure of pulpwood production, especially in the relative proportions of labour and machine costs. Below are some representative cases:

Case I A New Brunswick company whose operations are mechanized at the "skidder level":

Labour:	59.0 per cent of total pulpwood cost.
Machine Cost:	26.6 per cent of total pulpwood cost.
Other Charges:	14.4 per cent of total pulpwood cost.

FIGURE 1-12



Source: National Accounts Income and Expenditures, D.B.S.
Forestry Statistics, D.B.S.

Case II Operation in same general region, mostly conventional:

Labour:	78.0 per cent of total pulpwood cost.
Machine Cost:	16.0 per cent of total pulpwood cost.
Other Charges:	6.0 per cent of total pulpwood cost.

Case III Mechanized operation (showing effect of change from a short-wood skidder operation to a tree-length operation):

	Proportion of Cost at Mill	
	Short-Wood (8')	Tree-Length
Payroll (labour, administration, etc.)	51%	43%
Roads	6%	6%
Machine Cost (trucks, skidders, loaders, supplies, etc.)	43%	51%
	100%	100%

Conclusion

The pulp and paper companies are fully aware of the rapid developments in more productive systems of harvesting currently taking place. They are participating in them to a reasonable extent and have the financial and technical resources to make full use of these advances as warranted.

However, productivity in any mechanical system of operation must necessarily depend on stand conditions, including composition, structure and size as well as (or perhaps more than) on machine characteristics. Continuing improvements in timber harvesting can only be brought about by a change in the technology of forest management as well as in that of harvesting methods. This is implicit in the present applications of these new systems which are almost entirely confined to the best stands available. Put into poor stands, they lose their effectiveness.1/

Very little research is being done to determine these relationships, which can be critical in deciding the course to be followed. There is the danger of ending up with expensive machine systems which are relatively unproductive and result in higher, rather than lower, costs. This, to a certain extent, is happening now.

1/ Some authorities dispute this point of view, holding that mechanized systems should, in time, prove economic in poor stands as well as good. They attribute current difficulties to the lack of mechanical reliability of present machines and to unfamiliarity of employees and management with the new systems.

The sawmilling industry will profit indirectly from the developments in harvesting systems. The greatest gains will be in integrated operations.

The Atlantic Provinces sawmilling industry pays most employees very little more than the legal minimum wage. When minimum-wage legislation was introduced in New Brunswick a few years ago several very small sawmills went out of business. The proposal to increase the minimum from $1.05 per hour to $1.25 will extend this effect and promote further reduction in the number of operations.

For woodlot owners the need is also for consolidation and better management. Consolidation would bring this group into the orbit of some of the present harvesting developments. This should be consolidation in the physical sense or through co-operative action - any means that will provide larger operating and marketing units.

Woodlots have a big asset in excellent accessibility. Under such circumstances fairly simple harvesting methods can be effective, provided the scale of operation is large enough.

4. TRANSPORTATION OF WOOD TO THE MILL

The "prehaul" phase of logging transportation dealt with in the preceding section is an off-road, concentrating operation which is essentially a part of the logging method. It serves to accumulate the wood products at convenient locations or landings along the truck road system, for movement to the mills.

We are concerned here with this movement to the mills. It may be a direct movement by truck, or it may be two-phased. In the latter case the first phase is always by truck and the second by river drive or rail. In some regions there may be a third phase, by boat or barge, but this is not common in this region, except perhaps for export wood.

Transportation charges constitute a substantial portion of the total cost of wood at the mill. This proportion depends on the circumstances, including such items as hauling distance, whether or not road costs are included, and also on the total logging costs. Transportation unit costs do not vary as much as other components of the total cost because they are less dependent on labour costs which are the main variant from one region to another. Silversides (1964) estimates that transportation charges make up about 25 per cent of the cost of pulpwood at the mill; Corcoran (undated) places the range at 20 to 33 per cent.

The scope of the general transportation network and changes from 1951-52 to 1961-62 are indicated in Table 1-57.

TABLE 1-57

Volume of Pulpwood Delivered to Mills, by Type of Transport, by Region, 1951-1962

Year	Region	Volume				
		Drive	Boat	Rail	Truck	Total
		000 cords				
1951-52	All	6,220	540	2,840	1,110	10,710
1956-57	Ont.-West	1,600	233	989	958	3,780
	Quebec	3,770	1,252	666	870	6,558
	Atlantic	995	52	399	498	1,944
	Total	6,365	1,537	2,054	2,336	13,282
1961-62	Ont.-West	2,270	409	1,185	1,617	5,481
	Quebec	2,890	1,247	300	826	5,263
	Atlantic	1,257	77	465	460	2,259
	Total	6,417	1,733	1,950	3,003	13,003

Source: Woodlands Section, Canadian Pulp and Paper Association.

This table shows the results of three surveys made by the Canadian Pulp and Paper Association. During the decade the drive dropped in relative importance but still accounted for 50 per cent of all pulpwood deliveries in 1962. In the Atlantic Region it showed a sharp gain.

In the country as a whole there were two other trends: a substantial drop in rail shipments and a sharp rise in truck deliveries. In the Atlantic Region these trends did not hold.

Background information about these trends and the subsequent changes in the network flow in the Atlantic Region are discussed in the following sections.

The River Drive

Although Table 1-57 shows an increase in the amount of "river wood" during the decade, there was an underlying change in the structure of driving which saw the abandonment of hundreds of miles of small streams in the upper reaches of watersheds and the concentration of driving (or rather, "floating") on the main streams and rivers.

The driving of small steams requires relatively heavy expenditures for stream improvements including the building of flushing dams and other works. It also requires a great deal of labour to keep the wood moving smoothly in the narrow and often crooked channels. Driving such streams may result in a total cost of $0.30 per ton-mile. On large streams and rivers, however, costs may be as low as $0.01, or even $0.005 per ton-mile on the best rivers.

Once the industry was able to abandon the sleigh haul in favour of trucking it became economical to extend the hauling distance and put the wood directly into a main stream rather than smaller tributaries.

Since 1962 river driving has lost further ground, in Canada as a whole and in the Atlantic Region. Progressively it has become possible to replace the shorter drives by direct trucking to take advantage of the more continuous deliveries of wood made possible by the introduction of articulated skidders, and to secure the savings in interest, insurance, storage and recovery from storage, resulting from lower inventories and more direct deliveries. These savings amount to $4 to $5 per cunit.

There is also a loss in sinkage on the river drive. The amount of this loss depends on species and degree of seasoning (drying out). Wood substance itself has a specific gravity of 1.5, and therefore the moisture content is the main factor in sinkage. The loss may be as low as 2 or 3 per cent on short drives, but may be much larger if the time spent in the water is extended. There is also some evidence that in modern methods of harvesting, which provide little time for seasoning, sinkage loss may be more severe.

In Nova Scotia, river driving has never been important and at the present time is not used at all.

In New Brunswick there has been a sharp drop in the quantity driven since 1962 with the abandonment of large drives on the Saint John and Nipisiquit Rivers and on some minor streams. On the Saint John the main factor was the building of the Mactaquac Dam and the consequent creation of a 60-mile stretch of still water. To continue the drive would necessitate towing the wood and putting it through a flume at the dam site, with the additional costs involved. There is a legal "right of passage" for a river drive, and when a dam is built it may be necessary for the builder to provide a bypass flume. However, this right does not include "use of the current", and in a situation of this kind the driving company cannot claim any compensation for the additional costs involved.

The only large drive in New Brunswick at present is that on the Restigouche and its tributaries, totalling about 350,000 cords for the Fraser Companies' mill at Atholville and the New Brunswick International Paper Company's mill at Dalhousie. There are also a few minor drives in the northern section, but the total for the province does not exceed 450,000 cords. It is not likely that the Restigouche drive will be abandoned in the foreseeable future.

In Newfoundland, river driving is quite important. Both pulp and paper mills there drive a part of their wood supply. Price (Nfld.) Ltd. reports that almost 90 per cent of its annual cut is river driven at some stage of its journey to the mill.

Boat and Barge Transportation

A great deal of high quality pulpwood is exported from the Atlantic Region by ship to Europe. Practically all of this wood from New Brunswick and Nova Scotia is shipped through the larger ports, where it is barked and seasoned before shipment.

Somewhat surprisingly there is no coastal movement of pulpwood to Nova Scotia mills. However, shipment of pulpwood by barge from the Digby area to the Irving pulpmill at Saint John is due to start soon.

In New Brunswick there is some movement of wood from small coastal ports to mills on the Gaspe and Saint Lawrence. This traffic, however, has been dwindling in recent years. A large-scale movement of chips by barge from the Irving sawmill at Chipman to the pulpmill at Saint John was started in 1967. The Irving interests have undertaken a radical change in the transportation of wood to the Chipman and Saint John mills. This is discussed more fully in the following section.

Rail Transportation

Table 1-57 shows a very substantial decline in rail transportation of pulpwood in the decade 1952-1962. However, the decline was much greater in the first five years of this period than in the second, and in some regions, including the Atlantic, the downward trend was actually reversed.

In general, the statement can be made that rail transportation of roundwood, both pulpwood and sawlogs, is continuing to decline slowly because of increasing competition from trucks, but the rapid increase in the rail transportation of chips more than redresses the loss. There is good reason for this. Sawmill chips originate at relatively large sawmills, almost all of which are located on railroad lines. The transportation of these chips to the pulp mills is, therefore, largely a point-to-point movement by rail. Rail transportation of roundwood, however, involves a two-phase movement, first by truck to railhead and then to the mill, with the consequent additional transfer charges which tend to be quite high.

Thus, railroads are in a better competitive position vis-a-vis trucks in chip transportation than in the movement of roundwood. While there is a great deal of variation depending on volume and other circumstances, the break-even point appears to be roughly at about 70 miles for chips and 100 miles for roundwood.

Table 1-58 shows the movement of roundwood and chips to New Brunswick and Nova Scotia mills via Canadian National Railway in 1965. For the two provinces combined, the total weight of primary forest products moved by the C.N.R. in 1963 was equivalent to about 275,000 cords.

TABLE 1-58

Primary Forest Products Transported by Canadian National Railway, Nova Scotia and New Brunswick, 1965

Commodity	Origin	Destination	
		Nova Scotia	New Brunswick
		tons	tons
Pulpwood	N.S.	120,183	734
	N.B.	-	74,570
	P.E.I.	14,207	-
	Que.	-	36,330
	Total	134,390	111,634
Pulpwood Chips	N.S.	133,203	56
	N.B.	-	213,933
	Que.	-	4,148
	Total	133,203	218,137
Logs	N.S.	489	980
	N.B.	2,089	3,261
	Que.	36	924
	Total	2,614	5,165

Source: Canadian National Railway.

The Canadian Pacific Railway (including the Dominion Atlantic Railway) recorded movements in terms of carloads and did not distinguish between pulpwood in the round and pulpwood in chip form. C.P.R. figures for 1965 for Nova Scotia and New Brunswick translated into cords total approximately 225,000 cords.

The total in these two provinces was therefore the equivalent of 500,000 cords in 1965 delivered by rail. Ninety-five per cent was pulpwood in one form or another. The indications are that for the year 1966 the volume increased by about 20 per cent, due largely to the increasing movement of chips. The transportation of sawlogs by either railroad is not significant.

As a matter of interest the pulpwood transportation flow in the United States is strikingly different from that in Canada. A statement put out by the American Pulpwood Association in 1964 indicated that 50 per cent of all pulpwood (including chips) was moved to the mills by rail, 40 per cent by truck and 10 per cent by barge.

Movement of Roundwood

The movement of roundwood by rail presents serious difficulties. I.W. Mitchell, of the research staff of the C.N.R. at Moncton, in a paper presented to the Pulpwood Transportation Conference of the Canadian Pulp and Paper Association in 1962, pointed out that pulpwood was loaded at approximately 1,000 stations along the railroad's system and that the average volume originating at these stations was 2,560 tons, but that there were many stations from which extremely low volumes of 200 tons or less originated. This type of loading pattern greatly increases the cost of car distribution, the length of car cycle and the difficulty of scheduling generally. A sampling of the pulpwood rail traffic to five large mills in Eastern Canada showed that the empty transit time to loading point was approximately six days; time at the loading point, about seven days; loaded transit time, four days; and unloading at the mill, three days. This means a cycle or round-trip time of 20 days and shows the extraordinarily low car-utilization which can result, and in fact has resulted, from this traffic. Although the situation has improved somewhat, the basic difficulty remains.

Rail transportation of pulpwood in the United States has run into similar difficulties. In a recent report (November, 1966) to the American Pulpwood Association by the Louisville and Nashville Railroad Company, dealing with the southern part of its territory where the railroad was using 1,500 cars to move wood an average distance of 108 miles from 44 wood concentration yards to seven pulp mills, normal trips per month were 2.4 for a cycle time of 12.5 days. To improve this, the railroad set up a linear programming transportation model which has been instrumental in bringing about a 25-per-cent improvement, to 3.0 round trips per month.

In New Brunswick a recent readjustment of the transportation network has benefited the railroads greatly. This readjustment resulted from developments in chipping and abandonment of river driving and involves mostly the Irving interests, but to some extent also the Fraser Companies Limited. It also indicates a new competitive spirit on the part of the railroads.

Fraser Companies Limited for many years has shipped chips from its sawmill at Plaster Rock to its Edmundston pulpmill by rail, but it has also shipped a great deal of pulpwood in the round by truck directly in the same direction. Now all wood originating on the Plaster Rock timber limits goes to the sawmill, but part of the logs are diverted immediately to the chippers. In this way all the pulpwood originating from that area is now moved to Edmundston by rail in chip form.

For their part, the Irving interests have completely reorganized the supply lines of their Saint John pulpmill and of their sawmills. The changes, which are of paramount interest in a discussion of rail transportation, are described below.

The Saint John River drive, formerly the main means of supply for the pulpmill and sawmill at Saint John, has been abandoned except for that portion from Fredericton downstream. This short drive is mainly for the relatively small amount of wood originating on the Nashwaak River. The abandonment of the main drive necessitated closing the St. John sawmill. Meanwhile the company has built up its sawmilling and chipping facilities at Veneer Siding on the borders of Madawaska and Victoria counties (the area from which a great deal of the pulpwood for the Saint John River drive originated), and at Chipman at the head of Grand Lake.

At the present time the pulpmill at Saint John is supplied largely from three sources: wood purchased from woodlot owners within a radius of approximately 80 miles, chips from the Chipman sawmill and wood from the local holdings of the company. The sawmill at Chipman gets its logs from the company's lands in that district and other logs railed in from the company's operations in the Juniper area.

The company's large-scale woods operations at Veneer Siding produce hardwood and softwood logs which in turn are converted into lumber and chips. The softwoods and a small quantity of hardwood chips are shipped by rail to the Fraser pulpmill at Atholville, but most of the hardwood chips go to Saint John by rail and thence are exported to Scotland.

A brief description of the transportation arrangements is pertinent. First, there is a regular, almost year-round movement of about 15 carloads of chips per day from Veneer Siding to Atholville in a three-day round-trip circuit which is a part of the regular daily train service. This is interrupted only to deliver hardwood chips to Saint John to suit the arrival of cargo vessels for loading these chips for export.

There is somewhat similar rail-chip service between Chipman and Saint John during the winter. This, however, will be replaced by barge transportation during the summer via the Saint John River and Grand Lake. In this service barges towed by tugs will deliver oil products from the Irving Refinery to Fredericton (for further distribution) and to Chipman, and will return with large deck-loads of chips.

Movement of Chips

The rail movement of chips outlined above and the similar traffic between Plaster Rock and Edmundston are the most important ones in New Brunswick. However, there are several cases of lesser chip traffic from smaller sawmills (down to an annual capacity of about 1.75 million f.b.m.) to pulpmills both in New Brunswick and Nova Scotia. It has been noted that the break-even point between truck and rail transportation of chips is about 70 miles, but there are instances of longer truck-hauls of chips. The Crabbe sawmill at Bristol, New Brunswick, for instance, trucks its chips to Old Town, Maine, a distance of 135 miles. The facts that this sawmill is not directly on a railroad, and that a rail haul, if instituted, would involve a transfer or reloading operation, may explain the economy of trucking this distance.

Chips are a relatively bulky product averaging about 25 pounds per cubic foot compared to about 35 pounds for roundwood pulpwood. They also present unusual problems in loading and unloading. The large-scale development of this traffic is recent - a little over 10 years - and the railroads, in many instances, seem not yet sure enough of their ground to be able to justify cars specially designed for this purpose. However, the C.N.R., as well as the Pacific Great Eastern in British Columbia and some railroads in the United States, has developed special large cars with high sides for chip transport. The C.N.R. special chip car has a capacity of 6,700 cubic feet with a top-hinged end-door designed for unloading by end-dumping.

There are very few of these cars yet in service and most of the traffic is by means of old box cars, modified by removing the roof and extending the sides and ends about 30 inches higher,[1] or by rapid-discharge steel hopper cars.

Loading and unloading chips presented new problems. The loading has now been properly solved. It is practically always pneumatic, and in the larger installations a string of cars can be loaded almost automatically by means of a winding device and electrical controls.

Unloading is more difficult. Chips do not unload well from a hopper car because they tend to bridge and block the opening. Pneumatic unloading is possible with the use of a "digger" to loosen the chips and get them into the air line. Front-end loaders may be used in unloading through the side door but probably end-dumping is most satisfactory if the cars are designed for this purpose.

In any event the regular, large-volume, long-term (several months), closed circuit (same cars in a turn-around service),regular train movement exemplified by some of the chip traffic described, is the most economical pattern of rail transportation. The railroads are able and willing to negotiate special arrangements to accommodate this sort of traffic.

1/ It has been found that removal of the roof results in serious loss on high speed trains and in such a case a paper-mesh covering is used.

It is somewhat difficult to get railroad rates which can be compared to trucking costs. From the published rates available it would appear that these rates run from about 5.0 cents per ton-mile for logs on a relatively short haul to 1.5 cents per ton-mile for chips on a long haul (about 200 miles). It can be assumed that privately negotiated rates on the large-scale, long-term deliveries described above would be considerably less, probably of the order of 1.0 cent per ton-mile on the longer hauls.

Truck Transportation

From what has been said so far it can be seen that river driving is not used in Nova Scotia and has declined abruptly in New Brunswick. The railroads have benefited from this change in New Brunswick. In general, the railroads can be expected to be more aggressive, and they enjoy some advantages in chip transportation. However, the main form of transportation and the one which will continue to increase most rapidly in importance is trucking, and especially direct trucking from the point of origin in the forest to the mill. The newer forms of timber harvesting described in the earlier part of this report result in a more or less continuous flow of wood, and this fits in nicely with direct trucking to the mill.

Because of the fact that some of the transportation of primary forest products and chips is complex, it is not easy to state the exact proportions in the system, but as an approximation and in order to give some idea of relative importance, it appears that if we consider all the primary forest products, including chips, transportation is effected in the following proportions in New Brunswick and Nova Scotia taken together:

River Driving	12 per cent
Rail	14 per cent
Truck	74 per cent

It is thus seen that the road network and general organization and efficiency of trucking is of paramount importance to the forest industries in these two provinces.

The Road Network

Apart from the public road system, information on the road network is very meagre and warrants more detailed study. However, an attempt will be made to present as complete a picture as possible of the network in New Brunswick.

The public road system administered by the New Brunswick Department of Public Works totals 13,010 miles, of which 1,735 miles are paved, 2,595 miles bituminized and 8,680 miles gravelled. Functionally, this mileage is classified as follows:

Arterial highways	1,409 miles	
Collector roads	1,184 miles	
Branch roads	10,417 miles	
		13,010 miles

Besides these, some public roads have been built and are being maintained under other governmental authority:

Access roads (Dept. of Natural Resources and Federal Government)		365 miles

Private roads include the following:

Forest industry permanent roads (est.)	3,550 miles	
Other permanent private roads (est.)	200 miles	3,750 miles
Total permanent road network, Province of New Brunswick		17,125 miles

This mileage includes all permanent roads usable for truck traffic at all periods except during the spring breakup and only to a limited extent in the wet, freeze-thaw period in November. The road network is not uniform, being denser in the settled areas and sparser in the forested areas.

These mileage figures by themselves do not reveal much about the adequacy of the network for the forest industries. It may, therefore, be useful to present some figures on the road network for transportation of forest products in Sweden. Before doing this, however, it is useful to note that in Sweden the forest road network has been the subject of much thought and planning as a basic requirement for management of the resource as well as for transportation of forest products. Moreover, statistics on the network are collected at the same time that inventory information is gathered, at 10-year intervals. The following information is taken from "Truck Roads in Forestry - according to the Road Inventory carried out by the National Forest Survey" (von Segebaden, 1965). The figures include only the roads <u>within the forests or close enough</u> for the timber to be landed along them in a normal extraction operation.

Permanent roads are gravelled or otherwise surfaced, suitably ditched, and usable the year-round, except during the period of thaw. The density of these roads for the country as a whole is 1.25 miles per square mile. Sweden is very elongated in a north-south direction, and in the north goes well beyond the Arctic Circle. There is, therefore, a considerable variation in this road-network density. The survey in question divides the country into five regions, and the density varies from 0.6 miles per square mile in the far north to 3.0 in the south. About 70 per cent of these roads are private and 30 per cent public.1/ The average hauling or extraction distance to a permanent road is as follows:

Average for the country as a whole		0.5 miles
Range:	Far northern region	1.2 miles
	Southern region	0.2 miles

1/ Only about 25 per cent of the forest land is publicly owned.

In addition there is a large network of non-permanent truck roads, mostly for winter use. The density of this network is, on the average, 0.55 miles per square mile. As one would expect, this type of road is particularly useful in the northern part of the country where volume per acre is low and the winters are long. In the south these winter roads constitute 25 per cent of the total network, and in the north, 42 per cent.

In New Brunswick, if we include all permanent roads we get a road network density of 0.61 miles per square mile, or the equivalent of the network density in the far north of Sweden and less than half the national average for that country. Like Sweden, New Brunswick also has a large mileage of winter roads and other low-class roads, but there is no record of the extent.

The implication is quite clear. In comparison with the road network in a country considered to have a well-developed forest economy, New Brunswick's road network is deficient. The same could probably be said of Nova Scotia.

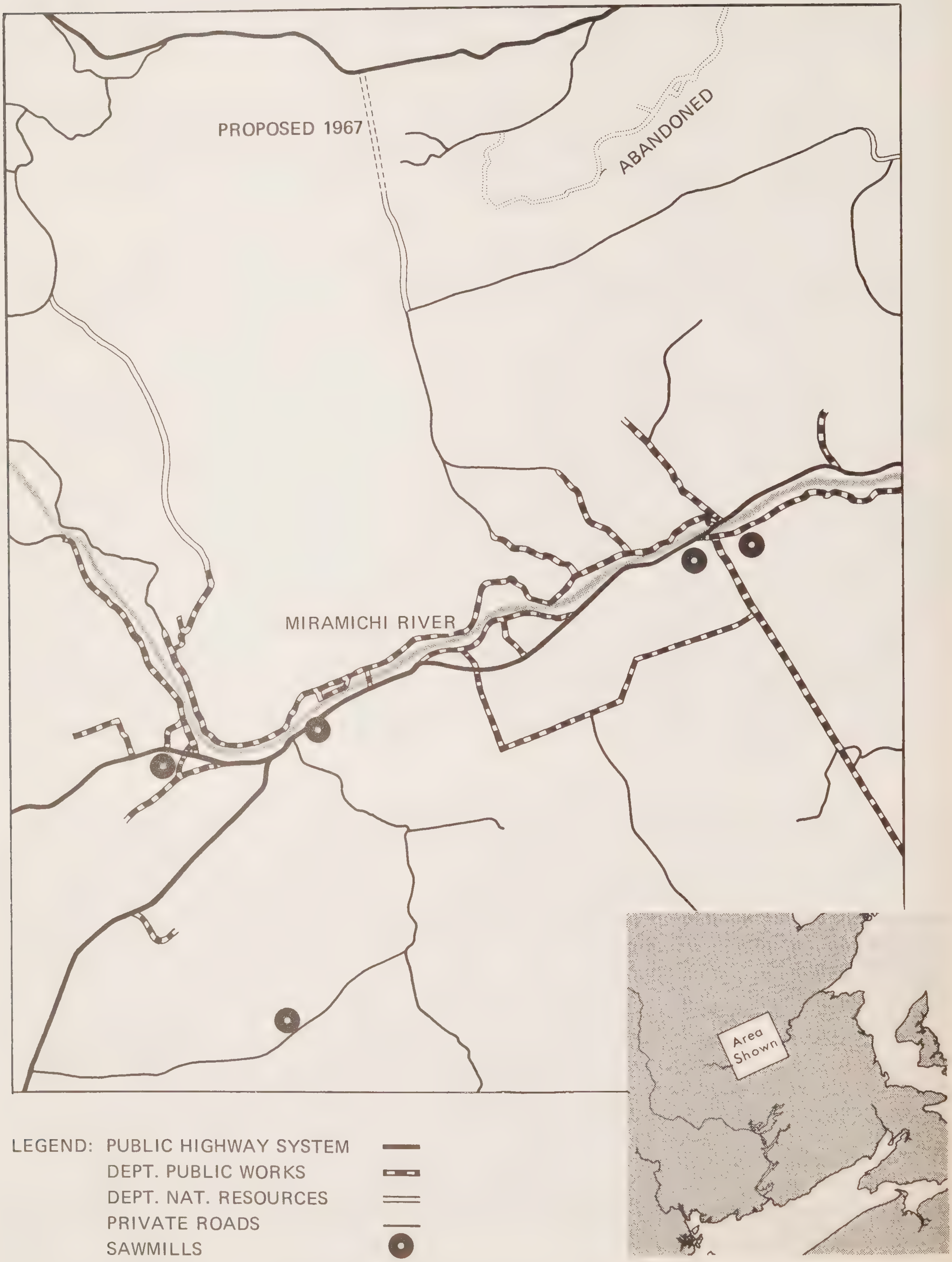
In a test area of almost exactly 1,000 square miles in the Boiestown-Doaktown area of New Brunswick, a survey of the road system was made (see Figure 1-13). This showed approximately 320 miles of what may be described as permanent roads for a road density of 0.32 miles per square mile. This is an intensively used forest area. There are eight sawmills and two pulp companies drawing wood from it. The area is split in two by the Fredericton-Newcastle highway, and along this section of the highway there is a relatively narrow strip of privately owned land. Here one finds a relatively dense road network, but as one moves away from the highway, the density drops abruptly. It is, in effect, a strip development, and there is a great need to improve the road system for feeders to the existing sawmills. This has been recognized by the Department of Natural Resources which has been building access roads in this area. However, the rate of progress is very slow. The accessibility of this area for reasonable utilization and management is much too low, especially when one also consideres potential recreational use for fishing and hunting.

Besides being deficient, the network in this area is also complex. Part of these roads are public highways under the jurisdiction of the Department of Public Works, some sections were built and are maintained by the Department of Natural Resources and some are privately built roads on Crown lands. There is no uniformity of standards, and on some sections of public roads the province does not assume responsibility for snow-plowing. Private individuals in this area charge tolls for the use of their sections of road by other parties.

The remission of gasoline tax, now in effect when hauling on privately built roads, is difficult to administer under these circumstances and does not serve a constructive purpose. It has been suggested that a more satisfactory alternative would be a main-road network, co-operatively planned by the government and the industries concerned, with roads built by the government and tolls charged to users on a cord- or ton-mile basis. Most of the forest products concerned originate on Crown lands; the government is aware of the quantities and could collect tolls as it does stumpage fees. Wood from private sources could be accommodated under this scheme without much difficulty.

FIGURE 1-13

ROAD SYSTEM, BOIESTOWN – DOAKTOWN AREA, NEW BRUNSWICK.



Some of the benefits which would accrue from such a co-operatively planned access-road system are:

1) The supply situation for the sawmills in the area would be eased;

2) Forest management and fire protection could be improved;

3) Sawlog and pulpwood transportation would be more efficient and less costly;

4) Commuter logging would be stimulated, thus raising labour standards and insuring a more stable labour supply;

5) The forest would be more accessible for recreational use.

The provincial government recognizes the need of revising its road policy. K.B. Brown, former Deputy Minister of Natural Resources for New Brunswick, has been asked to take on the task of examining the situation and making recommendations.

While comparable information on the Nova Scotia road network is lacking, the situation in that province is assumed to be similar. In New Brunswick, refunds of gasoline tax for use of vehicles on private roads has been a particularly thorny problem, with no easy, direct solution. However, the New Brunswick government is proposing to introduce legislation whereby it would make a contribution of $300,000 a year to the forest industry in lieu of gasoline tax refunds, the fund to be administered by the Forest Products Association for use in road building, particularly in the opening up of new areas. A similar program is already in effect in Nova Scotia. These are progressive steps, but it is not known whether such contributions, by augmenting normal road-building programs, will be sufficient to bring about a reasonable development of road networks.

Organization of Truck Transportation

Trucking of wood is an enterprise which can be entered into without much capital. There are, therefore, a large number of independent truckers, mostly owning a single truck but sometimes two, three, or more. The trucker may be a logging contractor, carrying out both the harvesting and transportation functions, but more often he concentrates on transportation.

The most commonly used truck is a ten-wheel, three-axle vehicle with the second rear axle dead. The carrying capacity of these trucks is generally in the five- to seven-cord range. When used for sawlogs they are often equipped with simple cranes or other loading devices. The loading of pulpwood on small jobs is manual, but on large operations mobile hydraulic-grapple loaders are usual. In general, the move from four- to eight-foot pulpwood has facilitated loading, because the four-foot piles tend to break down more readily with mechanical loaders.

The sort of truck described is useful for moderate distances, but beyond 40 or 50 miles unit-hauling costs become progressively greater and larger trucks more advantageous. These large units, which take loads up to the allowable highway limits of 74,000 pounds (gross vehicle weight), are more expensive to purchase, and special arrangements are, therefore, necessary for their acquisition.

This can be accomplished in a number of ways. Nova Scotia Pulp Company, for example, first establishes the specifications for the most economical truck for the routes in question and makes it possible for its selected truck contractors to purchase this equipment through the banks by writing fairly substantial, long-term agreements. Rothesay Paper Company has set up a separate corporation, Forest Transport, mostly - but not entirely - financed by the parent company. Forest Transport, which uses a fleet of 18 tandem-drive tractors and dual-axle semi-trailers, hauls about 80,000 cords per year over an average hauling distance of 66 miles, with a range of 25 to 90 miles. Loads average 11.5 cords.

Other pulp and paper companies buy the heavier units they require and rent smaller units locally. One company leases its trucks as well as its other logging equipment.

Problems in Trucking

It can readily be seen that truck transportation is of great importance to the forest industries, and its importance will increase. Deficiencies in the quality and extent of the road network and dissatisfaction with the collection and refunding of the gasoline tax when hauling on private roads are problems discussed above. Complaints have also been voiced from time to time about the restriction on hauling caused by weak bridges. This is a local rather than a general problem, and seems to be more acute in Nova Scotia than in New Brunswick.

However, the more serious problems arise from the general restrictions on weight allowance (wheel loading) and on load widths.

In any form of transportation, the load carried is one of the main determinants of cost because overhead and unit labour costs tend to decrease with increase of load. This is especially true in long-distance transportation in which loading and unloading represent only a small part of the expense.

At the same time, highway authorities have become increasingly aware of the damage which can be done to pavements by excessive wheel loads and have set strictly enforced load limits.

Loggers are not happy about the load limits. They say, for example, that it is extremely difficult to judge the weight of a load of logs or pulpwood because this varies with the species and with the degree of seasoning (drying out) of the wood; they feel that some allowance should be made for this variability. They point out that the State of Maine (and Ontario in some areas) allows an extra 10 per cent weight for primary forest products. In their view the difficulty is compounded when highway authorities not only check the over-all loading but the wheel loading as well because, with wood products, it is difficult to achieve the proper weight distribution. Unfortunately, acceptable wheel loading is particularly difficult to achieve in tree-length hauling, which otherwise promises to be one of the most economical harvesting and transportation systems.

Another restriction which truckers find irksome is on the width of loads. The State of Maine, and Ontario and Quebec, allow logging trucks 102" compared to 96" in New Brunswick and Nova Scotia. This extra width is very convenient in the hauling of eight-foot wood, which is usually piled transversely on the truck and is usually about 100" in length. In hauling tree lengths the extra width is also a great convenience because tree lengths form a bulkier load.

The plea is often made that when the roadbed is frozen there should be no limit to the loading, or at least that permissible wheel loads should be considerably increased. In Maine loading can be increased by 15 per cent in December, January and February on payment of an additional fee of $25 per month. This adds up to a maximum G.V.W. for Maine in these months of 92,700 pounds for a five-axle truck. In Ontario, north of an east-west line through Orillia, there is also a 15-per-cent tolerance allowed in winter. In New Brunswick, a 10-per-cent increase was granted for the first time in February 1967 for about a six-week period.

The question of the strength of roadbed during winter is one which is not yet fully understood. Although the sub-grade gets stronger when frozen, pavement gets very brittle, and local failures may result. In addition, impact loading on bridges in sub-zero weather can be very severe. It is also true that winters are not the same everywhere and, especially in the seaboard provinces, there is normally a succession of freezing and thawing in winter. Two or three days of thawing can easily result in accumulation of water in local areas of the sub-grade or pavement, with consequent failure under excessive loads. In all, the administration of a program of extra loading in winter would not be without its pitfalls. Further research into the possibilities of extra-large tires for this sort of trucking might yield some answers.

The thawing-out period in spring means the stopping of all logging trucks because load allowances are too low to permit economical hauling. It is to be noted, however, that on the newer sections of Trans-Canada, good foundations, six-inch depth of paving and paving of the shoulders combine to make it possible to haul at full loads even during the thaw.

The whole matter of load allowances is something which must be negotiated between the forest industries and the respective governments. The forest industries are only one class of many commercial users of highways, and governments must attempt to reconcile all demands in the public interest.

Trucking Costs

Trucking costs naturally show a great variation depending on the road standard, distance of haul and size of unit. The following are some representative costs in New Brunswick for large units on mixed roads (paved and unpaved):

Length of Haul	Cost Per Ton-Mile
15 miles	6 cents
30 miles	5 cents
60 miles	4 cents
100 miles	$3\frac{1}{2}$ cents

On "best" paved roads and long hauls a cost of 3 cents per ton-mile can be achieved. This, of course, is for one-way hauling.

It is thus seen that river driving under certain conditions can be the cheapest form of forest transportation, although there are not many situations where these conditions hold. Railroads are highly competitive from point to point, especially over long, regular train runs on which a high rate of utilization can be achieved over an extended period of time. The great advantage of trucking is flexibility, making it the most generally useful method of direct transportation over a wide area.

Other Forms of Transportation

There is no other form of transportation which is an immediate challenger. The proposal to use pipelines for chip transportation caused a flurry of excitement two or three years ago but this has died down. More work has to be done on the engineering and economics of this method, and it appears that it may be useful only in special circumstances - at least in the next few years.

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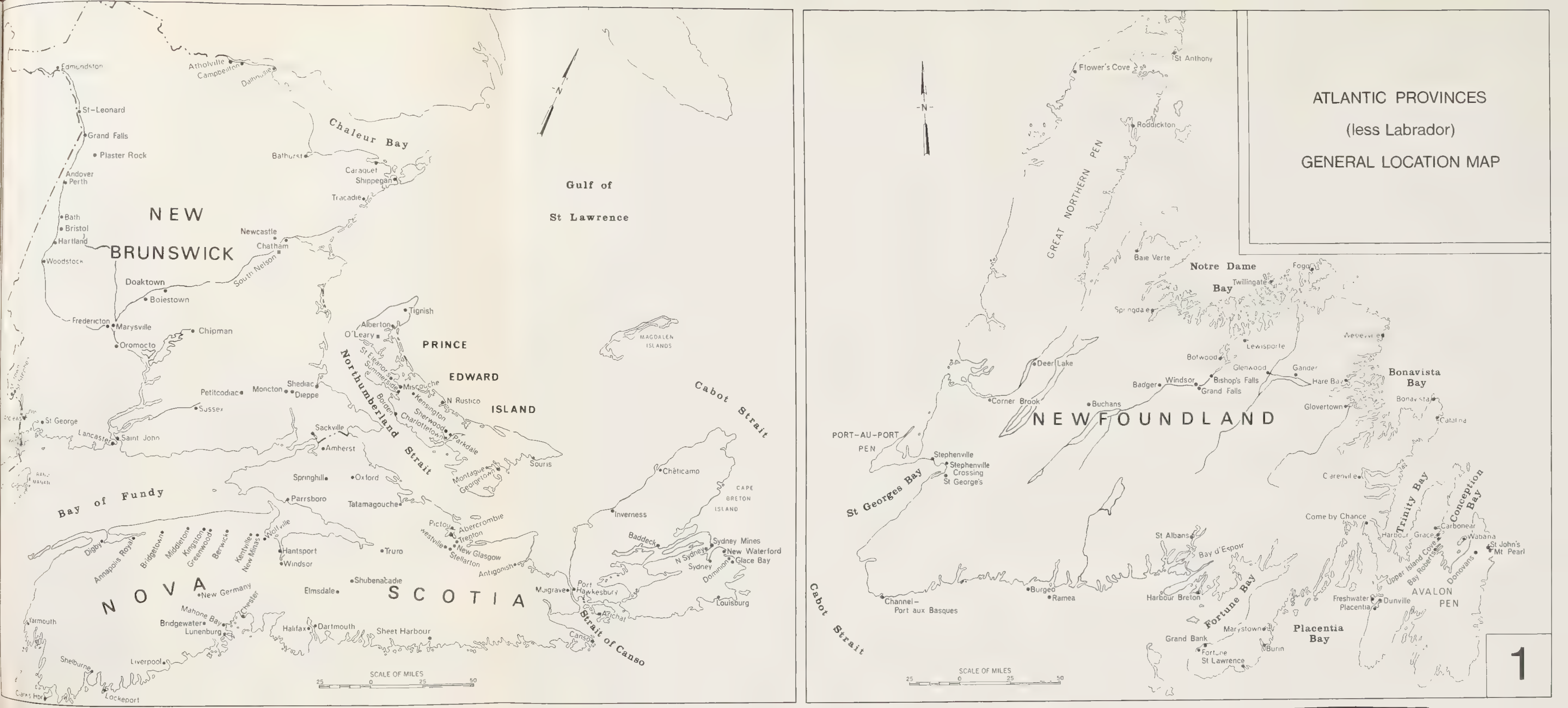
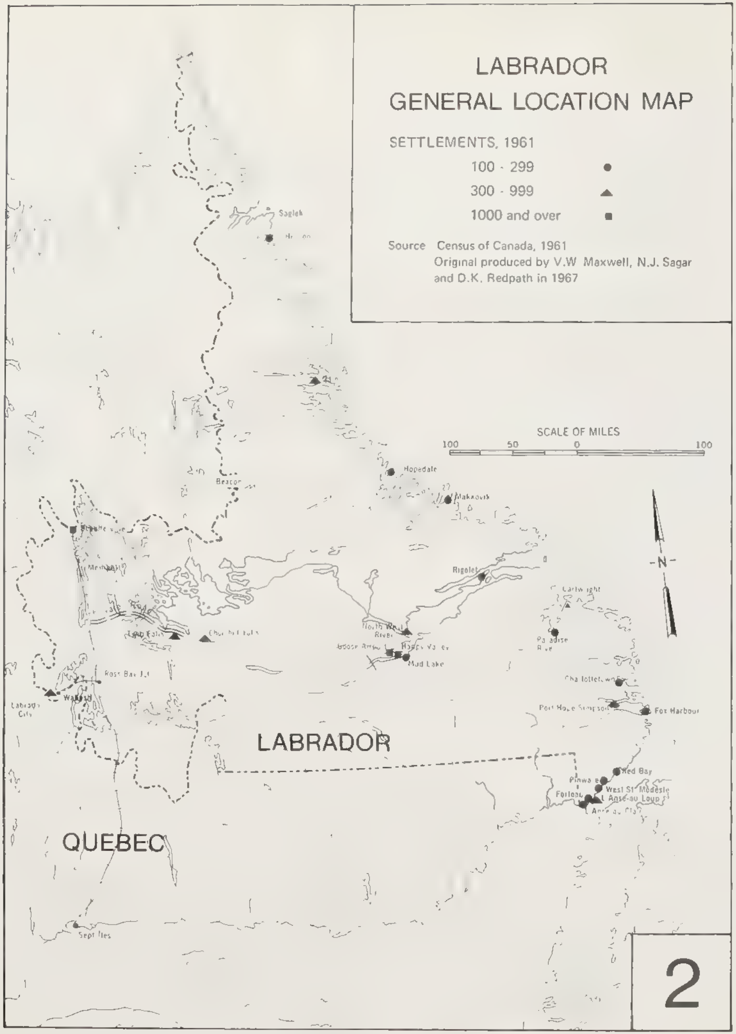
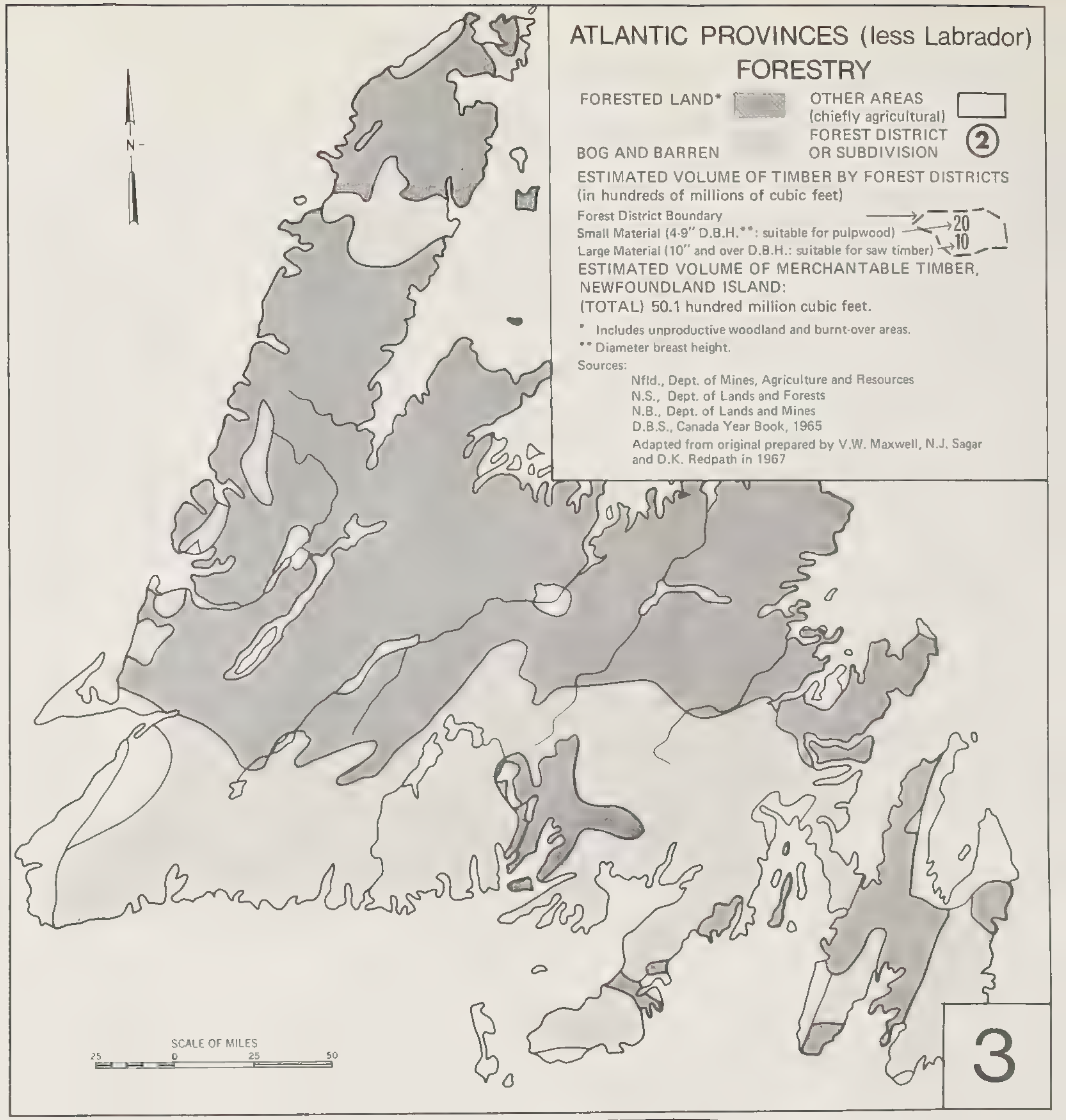

ATLANTIC PROVINCES
(less Labrador)
GENERAL LOCATION MAP
1
NEW BRUNSWICK
PRINCE EDWARD ISLAND
NOVA SCOTIA
NEWFOUNDLAND
Gulf of St Lawrence
Chaleur Bay
Bay of Fundy
Northumberland Strait
Cabot Strait
Strait of Canso
CAPE BRETON ISLAND
MAGDALEN ISLANDS
Edmundston
St-Leonard
Grand Falls
Plaster Rock
Andover
Perth
Bath
Bristol
Hartland
Woodstock
Atholville
Campbellton
Dalhousie
Bathurst
Caraquet
Shippegan
Tracadie
Newcastle
Chatham
South Nelson
Doaktown
Boiestown
Fredericton
Marysville
Oromocto
Chipman
Petitcodiac
Moncton
Shediac
Dieppe
Sussex
St George
Lancaster
Saint John
Sackville
Amherst
Springhill
Oxford
Parrsboro
Tatamagouche
Tignish
Alberton
O'Leary
St Eleanors
Summerside
Miscouche
Kensington
Borden
Sherwood
Charlottetown
N Rustico
Parkdale
Montague
Georgetown
Souris
Pictou
Abercrombie
Trenton
Westville
Stellarton
New Glasgow
Antigonish
Truro
Digby
Annapolis Royal
Bridgetown
Middleton
Kingston
Greenwood
Berwick
Kentville
New Minas
Wolfville
Hantsport
Windsor
Shubenacadie
Elmsdale
New Germany
Chester
Mahone Bay
Bridgewater
Lunenburg
Halifax
Dartmouth
Sheet Harbour
Yarmouth
Shelburne
Liverpool
Lockeport
Mulgrave
Port Hawkesbury
Arichat
Canso
Chéticamp
Inverness
Baddeck
Sydney Mines
New Waterford
Glace Bay
N Sydney
Sydney
Dominion
Louisburg
SCALE OF MILES
25 0 25 50
St Anthony
Flower's Cove
Roddickton
GREAT NORTHERN PEN
Baie Verte
Notre Dame Bay
Fogo
Twillingate
Springdale
Lewisporte
Botwood
Glenwood
Gander
Hare Bay
Deer Lake
Badger
Windsor
Bishop's Falls
Grand Falls
Corner Brook
Buchans
Bonavista Bay
Bonavista
Glovertown
Catalina
PORT-AU-PORT PEN
Stephenville
Stephenville Crossing
St George's
St Georges Bay
Clarenville
Trinity Bay
Conception Bay
Come by Chance
Carbonear
Harbour Grace
Wabana
St John's
Mt Pearl
Upper Island Cove
Bay Roberts
Donovans
AVALON PEN
St Albans
Bay d'Espoir
Harbour Breton
Fortune Bay
Freshwater
Placentia
Dunville
Placentia Bay
Marystown
Burin
Grand Bank
Fortune
St Lawrence
Burgeo
Ramea
Channel-Port aux Basques
-N-

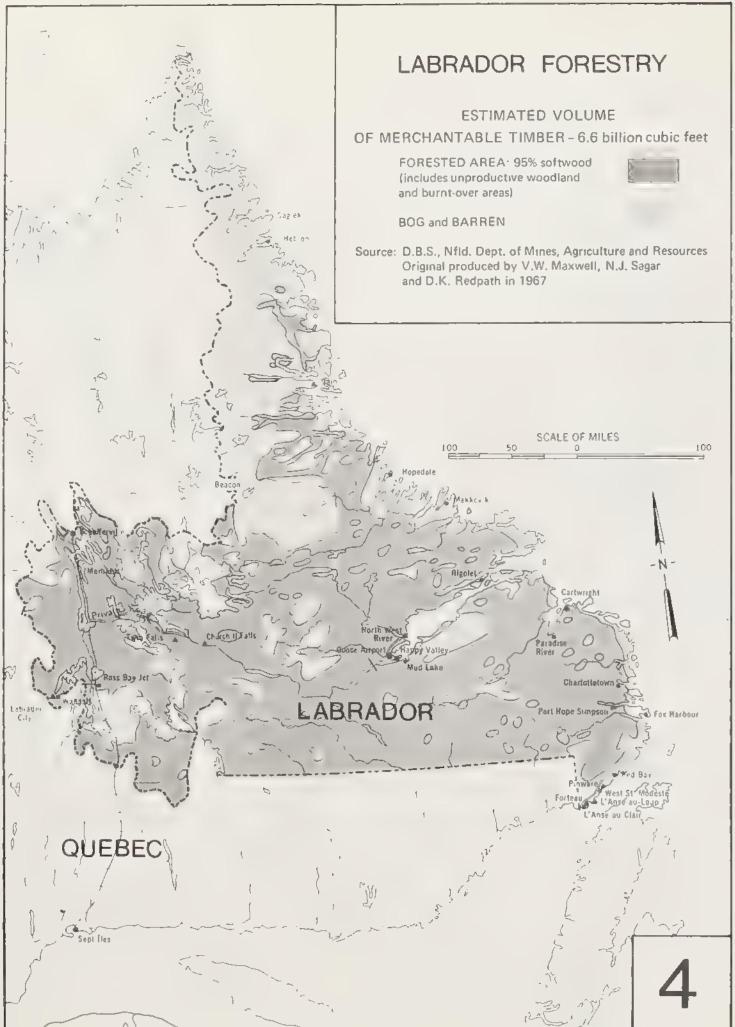


LABRADOR
GENERAL LOCATION MAP
SETTLEMENTS, 1961
100 - 299
300 - 999
1000 and over
Source Census of Canada, 1961
Original produced by V.W. Maxwell, N.J. Sagar
and D.K. Redpath in 1967
SCALE OF MILES
100
50
0
100
-N-
Saglek
Hopedale
Makkovik
Beacon
Rigolet
Cartwright
North West River
Happy Valley
Mud Lake
Churchill Falls
Ross Bay Jct
Labrador City
Charlottetown
Port Hope Simpson
Fox Harbour
Red Bay
Pinware
West St. Modeste
Forteau
L'Anse-au-Loup
LABRADOR
QUEBEC
Sept Iles
2

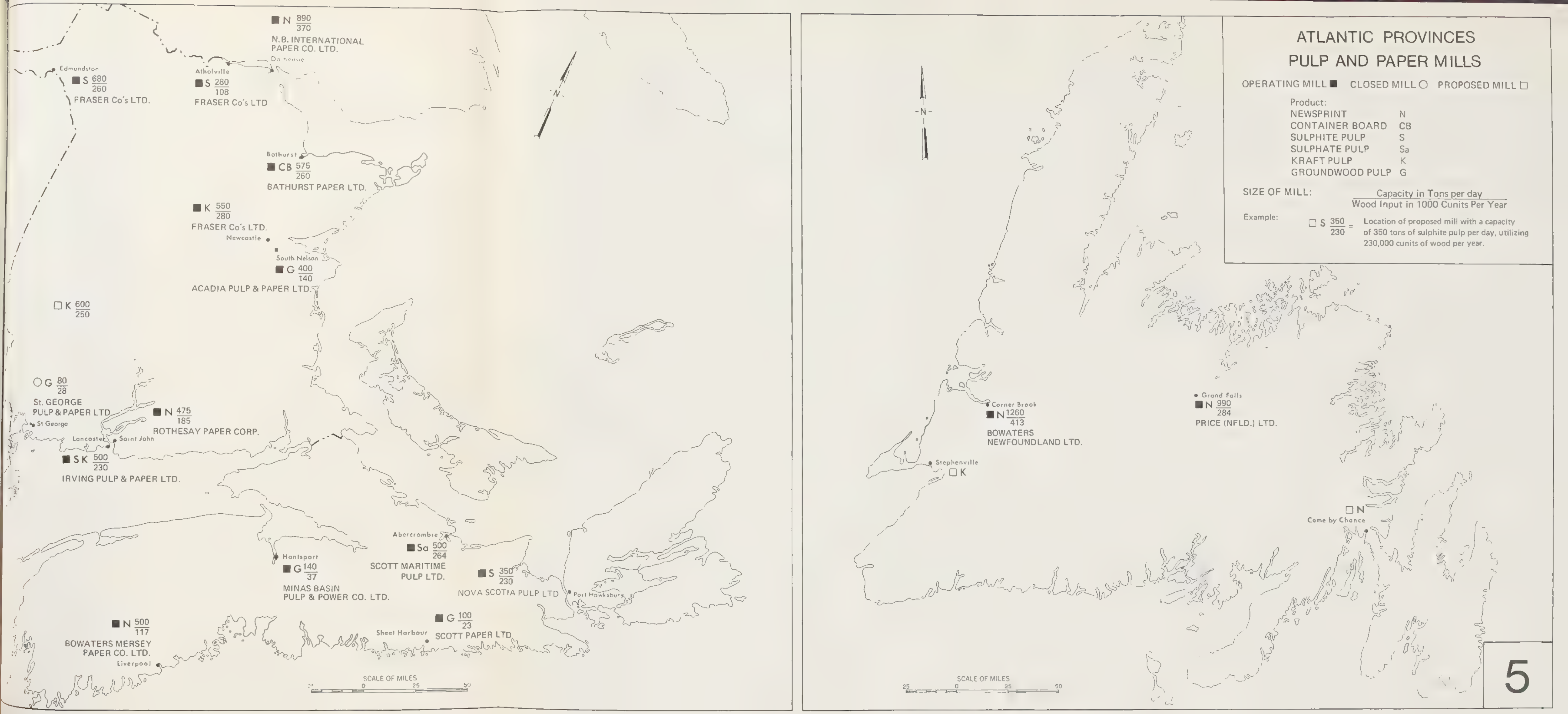

N
16
17
5
22
21
1
25
15
2
4
20
12
22
9
3
2
12
7
2
7
5
4
7
5
6
7
4
5
3
12
7
12
7
1
17
10
7
SCALE OF MILES
25
0
25
50

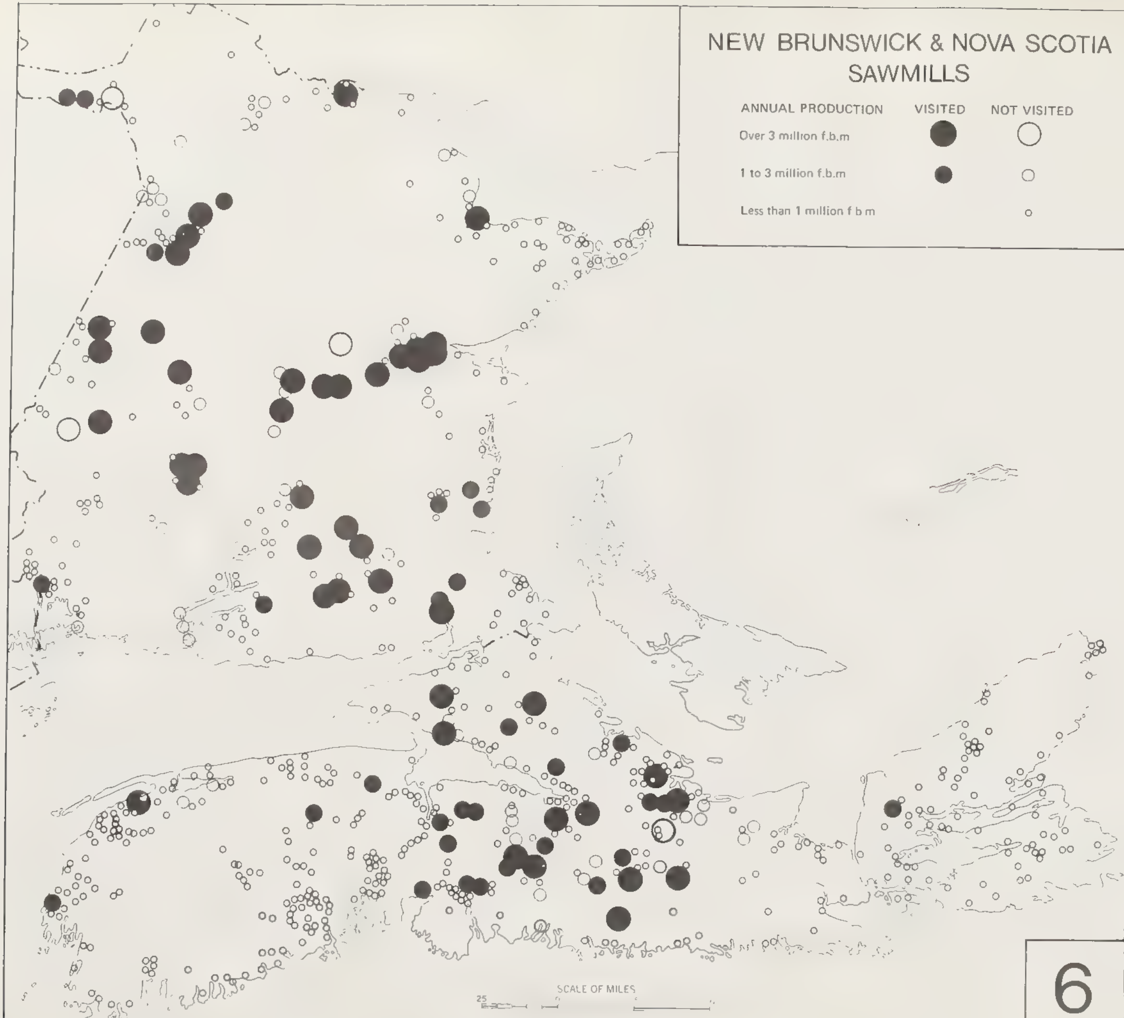

ATLANTIC PROVINCES (less Labrador)
FORESTRY
FORESTED LAND*
OTHER AREAS
(chiefly agricultural)
FOREST DISTRICT
OR SUBDIVISION
2
BOG AND BARREN
ESTIMATED VOLUME OF TIMBER BY FOREST DISTRICTS
(in hundreds of millions of cubic feet)
Forest District Boundary
Small Material (4-9" D.B.H.**: suitable for pulpwood)
Large Material (10" and over D.B.H.: suitable for saw timber)
20
10
ESTIMATED VOLUME OF MERCHANTABLE TIMBER,
NEWFOUNDLAND ISLAND:
(TOTAL) 50.1 hundred million cubic feet.
* Includes unproductive woodland and burnt-over areas.
** Diameter breast height.
Sources:
Nfld., Dept. of Mines, Agriculture and Resources
N.S., Dept. of Lands and Forests
N.B., Dept. of Lands and Mines
D.B.S., Canada Year Book, 1965
Adapted from original prepared by V.W. Maxwell, N.J. Sagar
and D.K. Redpath in 1967
N
SCALE OF MILES
25
0
25
50

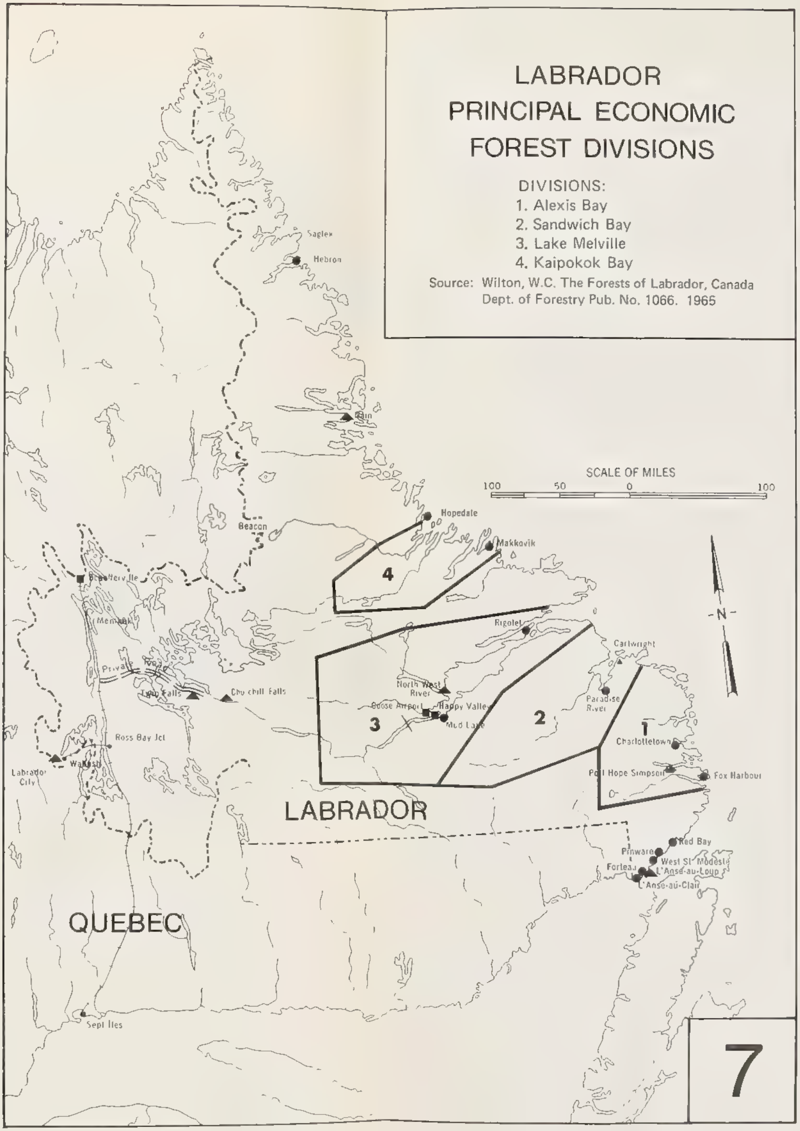
3



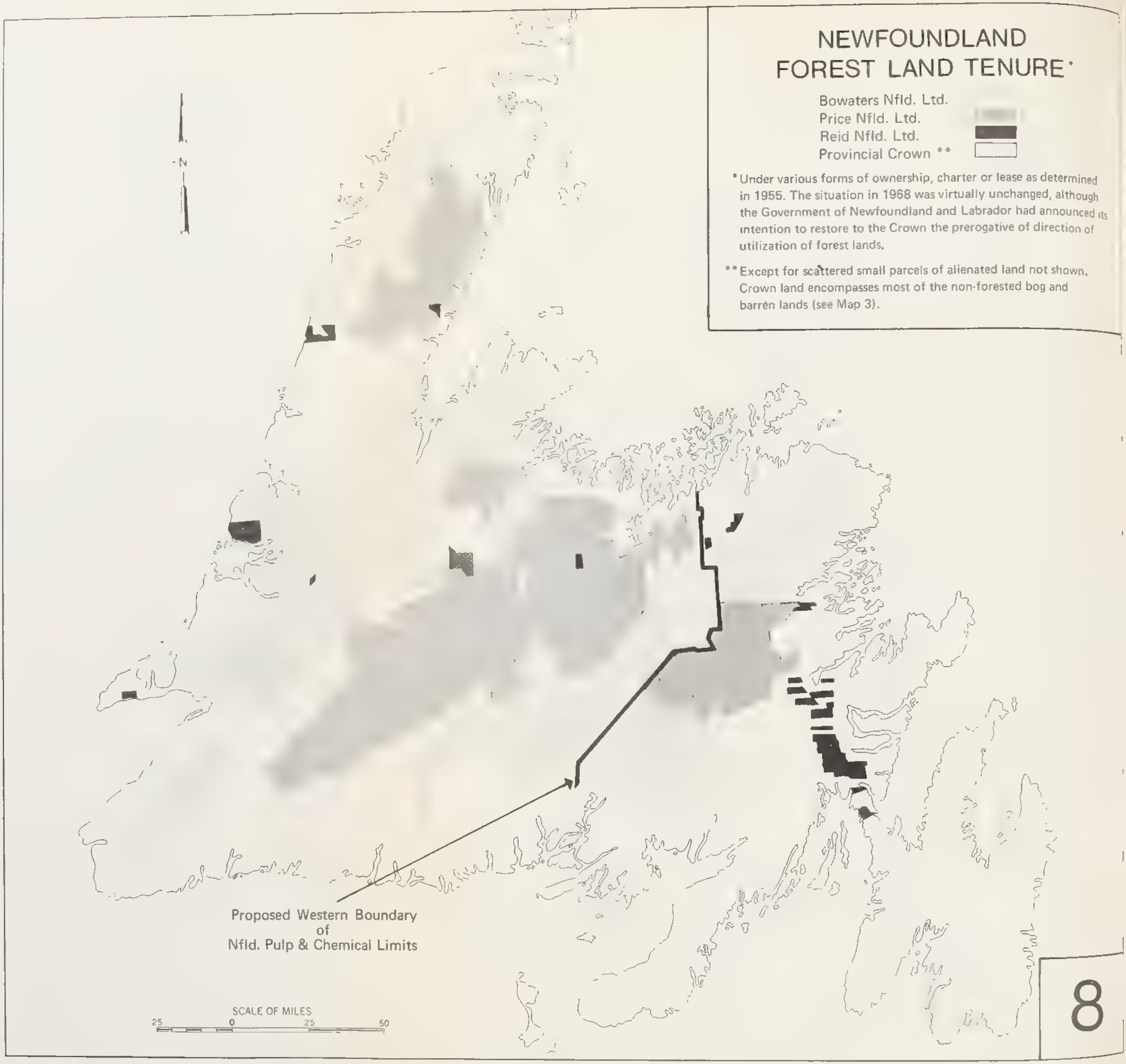
LABRADOR FORESTRY
ESTIMATED VOLUME
OF MERCHANTABLE TIMBER - 6.6 billion cubic feet
FORESTED AREA· 95% softwood
(includes unproductive woodland
and burnt-over areas)
BOG and BARREN
Source: D.B.S., Nfld. Dept. of Mines, Agriculture and Resources
Original produced by V.W. Maxwell, N.J. Sagar
and D.K. Redpath in 1967
SCALE OF MILES
100
50
0
100
Hopedale
Beacon
N
Rigolet
Cartwright
North West River
Goose Airport
Happy Valley
Mud Lake
Church II Falls
Ross Bay Jct
Paradise River
Charlottetown
Port Hope Simpson
Fox Harbour
Pinware
West St Modeste
Forteau
L'Anse au Loup
L'Anse au Clair
LABRADOR
QUEBEC
Sept Iles
4


ATLANTIC PROVINCES
PULP AND PAPER MILLS
OPERATING MILL ■ CLOSED MILL ○ PROPOSED MILL □
Product:
NEWSPRINT N
CONTAINER BOARD CB
SULPHITE PULP S
SULPHATE PULP Sa
KRAFT PULP K
GROUNDWOOD PULP G
SIZE OF MILL: Capacity in Tons per day / Wood Input in 1000 Cunits Per Year
Example: □ S 350/230 = Location of proposed mill with a capacity of 350 tons of sulphite pulp per day, utilizing 230,000 cunits of wood per year.
■ N 890/370
N.B. INTERNATIONAL PAPER CO. LTD.
Dalhousie
Edmundston
■ S 680/260
FRASER Co's LTD.
Atholville
■ S 280/108
FRASER Co's LTD
Bathurst
■ CB 575/260
BATHURST PAPER LTD.
■ K 550/280
FRASER Co's LTD.
Newcastle
South Nelson
■ G 400/140
ACADIA PULP & PAPER LTD.
□ K 600/250
○ G 80/28
St. GEORGE PULP & PAPER LTD
St George
■ N 475/185
ROTHESAY PAPER CORP.
Lancaster
Saint John
■ S K 500/230
IRVING PULP & PAPER LTD.
Abercrombie
■ Sa 500/264
SCOTT MARITIME PULP LTD.
Hantsport
■ G 140/37
MINAS BASIN PULP & POWER CO. LTD.
■ S 350/230
NOVA SCOTIA PULP LTD
Port Hawksbury
■ G 100/23
Sheet Harbour
SCOTT PAPER LTD.
■ N 500/117
BOWATERS MERSEY PAPER CO. LTD.
Liverpool
SCALE OF MILES
25 0 25 50
N
Corner Brook
■ N 1260/413
BOWATERS NEWFOUNDLAND LTD.
Stephenville
□ K
Grand Falls
■ N 990/284
PRICE (NFLD.) LTD.
□ N
Come by Chance
SCALE OF MILES
25 0 25 50
5


NEW BRUNSWICK & NOVA SCOTIA SAWMILLS
ANNUAL PRODUCTION
VISITED
NOT VISITED
Over 3 million f.b.m
1 to 3 million f.b.m
Less than 1 million f b m
SCALE OF MILES
25
6



LABRADOR
PRINCIPAL ECONOMIC
FOREST DIVISIONS
DIVISIONS:
1. Alexis Bay
2. Sandwich Bay
3. Lake Melville
4. Kaipokok Bay
Source: Wilton, W.C. The Forests of Labrador, Canada
Dept. of Forestry Pub. No. 1066. 1965
SCALE OF MILES
100
50
0
100
N
Saglek
Hebron
Hopedale
Makkovik
Beacon
Rigolet
Cartwright
North West River
Goose Airport
Happy Valley
Mud Lake
Paradise River
Charlottetown
Port Hope Simpson
Fox Harbour
Churchill Falls
Ross Bay Jct
Labrador City
Wabush
Private Road
LABRADOR
QUEBEC
Red Bay
Pinware
West St. Modeste
L'Anse-au-Loup
Forteau
L'Anse-au-Clair
Sept Iles
1
2
3
4
7


NEWFOUNDLAND
FOREST LAND TENURE*
Bowaters Nfld. Ltd.
Price Nfld. Ltd.
Reid Nfld. Ltd.
Provincial Crown **
* Under various forms of ownership, charter or lease as determined in 1955. The situation in 1968 was virtually unchanged, although the Government of Newfoundland and Labrador had announced its intention to restore to the Crown the prerogative of direction of utilization of forest lands.
** Except for scattered small parcels of alienated land not shown, Crown land encompasses most of the non-forested bog and barren lands (see Map 3).
N
Proposed Western Boundary
of
Nfld. Pulp & Chemical Limits
SCALE OF MILES
25
0
25
50
8

FORESTRY
in the
ATLANTIC PROVINCES

PART TWO

NOVA SCOTIA

PART TWO
CONTENTS

PART TWO
TABLES

PART TWO
TABLES

FORESTRY IN THE ATLANTIC PROVINCES

PART TWO: NOVA SCOTIA

1. NATURE AND DISTRIBUTION OF RESOURCE BASE

Land Capability Classes

Land capability for forestry, agriculture, recreation and wildlife is currently being assessed under the Canada Land Inventory program of the Agricultural Rehabilitation and Development Administration (ARDA). Initiated with a pilot study in 1964, the entire province is scheduled to be completed by 1969.

Forest land classification for Nova Scotia and the other Atlantic Provinces is summarized in Table 2-1. Wilson (1966) gives the productive forest area of the Atlantic Provinces as 46.9 million acres.

TABLE 2-1

Forest Land Classification, Atlantic Provinces, 1962

Land Class	N.S.	N.B.	P.E.I.	Nfld.	Atlantic Provinces	Canada
			thousand acres			
Forested land						
Productive	9,651	15,288	520	21,672	47,131	614,303
Non-productive	764	283	78	34,515	35,640	480,601
Total	10,415	15,571	598	56,187	82,771	1,094,904
Non-forested land						
Agricultural	867	970	664	35	2,536	155,304
Other	1,775	1,274	136	35,327	38,512	1,028,344
Total	2,642	2,244	800	35,362	41,048	1,183,648
Total land area	13,057	17,815	1,398	91,549	123,819	2,278,552

Sources: Canadian Forestry Statistics, 1962. D.B.S.; Census of Canada, 1961.

Estimated Wood Volume

Estimated total wood volume, by the first comprehensive provincial inventory as reported by Hawboldt and Bulmer (1958), is 7.8 billion cubic feet of softwoods and 4.0 billion cubic feet of hardwoods on a forest area of about 10 million acres. Although these must be considered the best estimates available of the current total wood inventory, substan-

tially more accurate estimates are expected when the re-inventory, begun in 1965, is completed in 1972.

The net merchantable pulpwood inventory and gross and net merchantable sawlog volumes for both softwood and hardwood species were also estimated by Hawboldt and Bulmer (1958). These are summarized in Tables 2-2 and 2-3.

Of these, the most reliable figures are those for gross total volume. Net merchantable volumes in cubic feet are undoubtedly conservative due to over-allowance for non-merchantable material. Both gross and net merchantable volumes in f.b.m. tend to be even more conservative, especially the net and the hardwood volume estimates. For example, the provincial total of 8.19 billion f.b.m. for softwoods represents a 48-per-cent reduction from gross merchantable for cull and non-operable areas, and approximately an 80-per-cent reduction from the total softwood inventory.

TABLE 2-2

Gross, Net, Total and Merchantable Volumes of Softwoods and Hardwoods in Nova Scotia, 1958

	Softwoods	Hardwoods	Total
	----- billion cu. ft. -----		
Gross total 1/	7.80	4.00	11.80
(Reduction factor)	(-40.3%)	(-65.0%)	(-48.6%)
Net merchantable 2/	4.66	1.40	6.06
	----- billion f.b.m. ------		
Gross merchantable 3/	15.80	2.60	18.40
(Reduction factor)	(-48.0%)	(-78.5%)	(-52.5%)
Net merchantable 4/	8.19	0.56	8.75

1/ Total stemwood volume of trees 4" d.b.h. and larger.
2/ Gross total volumes reduced 20% for stumps and tops, 20% for cull plus allowance for non-operable areas which, for softwoods, included any stratum containing less than 425 cu. ft. per acre.
3/ Stemwood volume, between a one-foot stump and a 6-inch top for softwood trees 8" d.b.h. and larger, hardwood trees 10" d.b.h. and larger, in f.b.m. by the New Brunswick Log Rule.
4/ Gross merchantable volumes reduced 20% for cull, plus allowance for non-operable areas which, for softwoods, included any stratum containing less than 2,000 f.b.m. per acre.

Source: Derived from Hawboldt and Bulmer (1958), p. 75-76.

TABLE 2-3

Gross, Net, Total and Merchantable Volumes of Softwoods and Hardwoods by Species, Nova Scotia, 1958, 1960

Species	Gross Volume 1/	Merchantable Volume 2/	Gross Merchantable 1/	Net Merchantable 1/
	---- billion cu. ft. ----		------- billion f.b.m. ------	
Softwoods				
Spruce	3.69	3.06	7.95	4.11
Balsam fir	2.99	2.48	4.01	2.08
Hemlock	0.47	0.39	1.71	0.88
Pine	0.55	0.46	2.02	1.05
Other	0.09	0.08	0.13	0.07
Total softwoods	7.79	6.47	15.82	8.19
Hardwoods				
Poplar	0.12	0.10	0.08	0.02
Birch	1.29	1.07	1.00	0.22
Maple	1.94	1.61	1.21	0.26
Other	0.64	0.53	0.30	0.06
Total hardwoods	3.99	3.31	2.59	0.56

1/ Volumes derived from Hawboldt and Bulmer (1958), p. 77-78.
2/ Canadian Forestry Statistics, 1960. D.B.S. p. 8.

A provincial government review of the softwood inventory, conducted in 1964, resulted in raising the estimated pulpwood volume by 25 million cords, or 2.125 billion cubic feet. This would have the effect of increasing the net merchantable volume of softwoods from 4.66 billion cubic feet (Table 2-2) to 6.80 billion cubic feet.

Similarly, both gross and net estimates of merchantable sawlog volumes in feet board measure (Tables 2-2 and 2-3) probably represent no more than one-half the inventory available.

A number of the difficulties encountered in interpreting this first inventory report should be overcome with the completion of the re-inventory which is now in progress.

Two basic volume estimates 1/ will result from the re-inventory:

(1) total cubic-foot stem volume from ground level to tip of tree, excluding bark, for living trees equal to or greater than four inches (3.6" +) d.b.h., over bark;

1/ For a description of the new volume estimates by L.S. Hawboldt, see Appendix.

(2) merchantable cubic-foot stem volume, excluding bark, stump (averaging 6" in height), and top to a utilizable top of not less than 3.6 inches in diameter inside bark, for living trees equal to or greater than four inches (3.6" +) d.b.h., over bark.

Table 2-4 summarizes the timetable for the Nova Scotia Forest Re-Inventory. The province is divided into seven subdivisions (I-VII), each subdivision consisting of two to four counties. The goal is to produce a report and maps for one subdivision each year. The cycle is then to be repeated, i.e., the province is to be re-inventoried continuously, with a new survey report and map series for one subdivision becoming available each year. Two years will normally transpire from the taking of the air photography to the publication of the report and maps for any particular subdivision.

TABLE 2-4

Target and Completion Dates,
Nova Scotia Forest Re-Inventory, 1967

Subdivision 1/	Photography Target	Photography Comp.	Interpretation Target	Interpretation Comp.	Field Work Target	Field Work Comp.	Compilation and Report Target Comp.	Mapping Target Comp.
I. Antigonish		1964		'64-'65		1965	Dec. 31 1967	Mar. 31 1967
II. Truro	1967		'67-'68		1968		1969	1969
III. Halifax		1966		'66-'67		1967	1968	1968
IV. Annapolis	1968		'68-'69		1969		1970	1970
V. Lunenburg		1965		'65-'66		1966	1968	1968
VI. Yarmouth	1969		'69-'70		1970		1971	1971
VII. C.B.I.	1970		'70-'71		1971		1972	1972

1/ Subdivisions contain the following counties:

Subdivision	Counties
I. Antigonish	Antigonish, Guysborough, Pictou
II. Truro	Colchester, Cumberland
III. Halifax	Halifax, Hants
IV. Annapolis	Annapolis, Kings
V. Lunenburg	Lunenburg, Queens
VI. Yarmouth	Digby, Shelburne, Yarmouth
VII. Cape Breton Island	Cape Breton, Inverness, Richmond, Victoria

Source: R.M. Bulmer.

Table 2-4 reveals, by inference, that some target dates have not been met. Mapping of Subdivision I, Antigonish, should have been completed in 1966, for example, not March 31, 1967. Perhaps more serious is the delay in completion of compilation and reports which, for Subdivision I, should have been in 1966, not December 31, 1967. However, much of the delay in meeting the schedule was reportedly due to problems in computer programming.

Growth, Loss and Stability

Growth Rate Estimates

Estimates of timber growth rates are usually less precise than estimates of standing timber volumes. Either a very large number of temporary sample plots must be established in order to develop normal or empirical yield tables (applicable only to essentially even-aged stands) or a series of representative permanent sample plots must be established and observed over several five-year periods in order to develop reliable estimates of rates of growth.

Hawboldt and Bulmer (1958) concluded:

> "Under present circumstances, 1/6 cord, or 22 f.b.m., per acre per year must be regarded as the average net merchantable yields of hardwood and softwood for the total forested lands in Nova Scotia."

Prior to 1958, the generally accepted figure for the average growth rate was 1/10 cord of four-foot wood, i.e., 8.5 cubic feet per acre per year. Hawboldt and Bulmer's estimate amounted to 14 cubic feet per acre per year. Preliminary estimates from the re-inventory (for Antigonish, Subdivision I) are 1/4 cord of eight-foot softwoods or 1/5 cord of eight-foot hardwoods. These growth rates correspond to 19.5 and 15.6 cubic feet of softwoods and hardwoods, respectively.

A re-assessment of the 1958 inventory report by a Cabinet committee (Canadian Pulp and Paper Ind., 1965) established a series of related factors which indicated a probability of 1/4 cord per acre per year rather than the 1/6 cord reported in 1958. The basic difference between the two estimates is attributed to the interpretation from gross volume of the growing stock, expressed as pulpwood, in the light of utilization as groundwood (the main use of Nova Scotia pulpwood in 1958). The 1964 study looked more strongly toward utilization for chemical pulping. The type of wood, and therefore the utilization from the growing stock, is quite different in the two cases.

Growth rates, for softwoods only, of 0.28 and 0.36 cords per acre per year are reportedly now in use for planning purposes by companies operating in eastern and central Nova Scotia respectively.

"Best" estimates of growth rates are therefore increasing with time, having doubled approximately in the past decade. The cord-volume estimates to 1958 were based on four-foot rough wood with an average solid-wood content of 85 cubic feet per cord; current (1965) cord-volume estimates are for eight-foot wood with an average wood content of 78 cubic feet per cord.

Current growth-rate estimates are more precise because they exclude stands with an average height of less than 30 feet and crown closures of less than 40 per cent. Overly dense, stagnated stands, on the one hand, and excessively sparse, understocked stands, on the other, are

TABLE 2-5

Growth-Rate Estimates, Nova Scotia

Source	Softwoods	Hardwoods	All Species
	merchantable cubic feet (cords) per acre per year		
Prior to 1958			8.5 (1/10)
Hawboldt & Bulmer (1958)			14 (1/6)
Cabinet committee (1964)1/	19.5 (1/4)		
Antigonish, Subdiv. I (1965)	19.5 (1/4)	15.6 (1/5)	

1/ Canadian Pulp and Paper Industry, August 1965.

therefore excluded in computing the average growth rate. The average yield-table stocking of the stands used is about 80 per cent; fully stocked stands would have an estimated net merchantable yield, exclusive of natural mortality, of 1/3 cord or 26 cubic feet per acre per year.

The tree age used to calculate average stand age is the free-growing projected age of dominant and co-dominant trees, measured at breast height, with a correction factor of ten years to convert to total age. Growth rate, or mean annual increment, is calculated by dividing merchantable cubic feet volume in the stand by the average stand age.

In addition, a system of permanent sample plots is being established to provide, eventually, an over-all check on the accuracy of the Nova Scotia normal yield tables and on the growth rates determined as above from the temporary forest-inventory sample plots. During the seven-year period 1965 to 1971, 250 permanent one-tenth-acre circular sample plots are being established annually for a total of 1,750. Plots are located at random within forested areas of the province. Re-measurement will commence in 1970, at five-year time intervals. Permanent sample-plot records and data will be processed by computer.

Loss and Stability

Standing dead trees are not included in provincial inventory figures. Hawboldt and Bulmer (1958) estimated the volumes of such trees at 1.4 billion cubic feet of both softwoods and hardwoods, amounting to 15 per cent and 25 per cent, respectively, of the total inventory. These wood volumes, contained in trees subject to earlier sporadic attacks, such as from birch die-back or spruce budworm, will not be included in future inventories because past losses cannot be utilized. However, it is anticipated that such mortality will become increasingly salvageable in the future.

Defect is the presence of decay or abnormalities that render a part of the log or bolt unmerchantable. Cull is the volume of wood that

is rendered unmerchantable by the presence of one or more defects; it may comprise all or only part of a log but often all of a bolt in which defect is present.

Defect and cull are not, in general, important variables in the estimation of Nova Scotia's merchantable softwood inventory. Together they may approximate about two per cent of the total softwood inventory. In hardwoods, defect and cull tend to be more common, but no reliable estimates are available because relatively few,and only the best quality, hardwood trees and logs are utilized.

Unstocked areas, estimated by Hawboldt and Bulmer (1958) to cover about 10 per cent of the total land area, include 1.3 million acres classified as depleted forest, brushland, rock barren, and old burn not restocking. No estimates are available as to the proportion of this land area that could or should be reforested. In the subdivisions re-inventoried to date (Subdivision I, Antigonish, and Subdivision V, Lunenburg) lack of stocking does not appear to be a serious problem.

Other factors affecting forest stability, such as insects, disease, fire and hurricane, will become less serious as forest management is intensified, as accessibility increases and as early utilization of most damaged trees becomes economically feasible.

Sustained Annual Yield Potential

The sustained annual yield potential was estimated by Hawboldt and Bulmer (1958, p. 80-81) to be 1.7 million cords (145 million cubic feet) or 216 million board feet, softwoods and hardwoods combined. The allowable cut was therefore estimated to be 1/6 cord (14 cubic feet) per acre per year if used for pulpwood, 22 board feet per acre per year if used for sawlogs.

However, these estimates are now considered quite conservative. Preliminary estimates from the re-inventory (1965) indicate annual growth rates for softwood of 1/4 cord per acre per year (19.5 cubic feet) and for hardwood of 1/5 cord (15.6 cubic feet).

In 1964, a government review of the 1958 inventory report resulted in an upward revision of the allowable annual cut of softwoods to 2.4 million cords (204 million cubic feet), an increase of 1.0 million cords or over 70 per cent. A similar scrutiny of the hardwood inventory and annual yield potential would probably lead to upward revisions of similar magnitude.

2. TENURE AND PRODUCTION

Land tenure of Nova Scotia's productive forests, in comparison with tenure in the other three Atlantic Provinces, is summarized in Table 2-6.

TABLE 2-6

Tenure of Productive Forest Lands, Atlantic Provinces, 1962

	Nova Scotia	New Brunswick	Prince Edward Island	Newfoundland Island	Newfoundland Labrador
	------ thousand acres ------				
Occupied forest land 1/					
Provincial Crown	747	6,658	-	4,324	12,300
Federal Crown	20	264	2	-	-
Private lands	7,459	7,925	515	1,118	-
Farm wood-lots (1961)	1,363	1,231	267	20	-
Other private	6,096	6,694	248	1,098	-
Total occupied	8,226	14,847	517	5,442	12,300
Unoccupied forest land					
Provincial Crown	1,425	390	2	2,868	1,062
Federal Crown	-	51	1	-	-
Total unoccupied	1,425	441	3	2,868	1,062
Total productive forest	9,651	15,288	520	8,310	13,362

1/ "Occupied" includes areas under lease or with special cutting rights.

Source: Canadian Forestry Statistics, 1962. D.B.S.

More recent statistics on Nova Scotia's forest land tenure are contained in the submission of the Forestry Sector to the Nova Scotia Voluntary Planning Board (1964, p. 8), as given here in Tables 2-7 and 2-8.

There is a marked discrepancy between the two sources with respect to the total area of Crown forest land; Table 2-6 lists about 2.2 million acres, whereas Tables 2-7 and 2-8 show 3.0 million. The difference, 0.8 million acres, presumably consists of non-productive forest-type lands.

TABLE 2-7

Forest Land Tenure in Nova Scotia, 1963

Ownership	Area	
	000 acres	%
Provincial Crown		
Total under lease	892	8
Designated by 1962 Act 1/	250	2
Unoccupied	1,858	17
Total Provincial Crown	3,000	27
Federal Crown	20	-
Farm woodlots (1961)	1,363	12
Other private woodland	6,851	61
Total forest-type lands (including waste lands)	11,234	100

1/ 1962 Bowaters-Mersey Agreement. The 1962 Act was an agreement with the provincial government which permitted, within a given number of years, the selection of alternative lands for those given up by Bowaters-Mersey on Cape Breton Island to Nova Scotia Pulp. These lands are not yet selected.

Source: Nova Scotia Voluntary Planning Board. Forest Industry Report. 1964.

TABLE 2-8

Forest Lands Ownership Pattern, Nova Scotia, 1963

Size and/or Type of Holding	Area	
	000 acres	%
Private, under 200 acres	4,500	39
Private, from 200 to 1,000 acres	1,800	15
Private, over 1,000 acres	900	8
Holdings of large companies	1,400	12
Holdings of Crown	3,000	26
Total forest-type lands	11,600	100

Source: Nova Scotia Voluntary Planning Board. Forest Industry Report. 1964.

TABLE 2-9

Distribution of Productive Forest Land Among Categories of Larger Owners, Nova Scotia, 1966

Type of Owner	No. of Owners	Free-hold	Prov. Crown Lease 1/	Federal Crown	Total	Per Cent of Co. Holdings	Per Cent of Total
	no.	----------	---------- 000 acres	----------	----------	%	%
Pulp and paper companies	4	1,635	1,436	-	3,071	87.6	31.8
Sawmilling companies	29	400	34	-	434	12.4	4.5
Sub-totals	33	2,035	1,470	-	3,505	100.0	36.3
Farm woodlots (1961)		1,363	-	-	1,363	-	14.1
Federal Crown	-	-	-	20	20	-	0.2
All other	-	4,061	702	-	4,763	-	49.4
Total	-	7,459	2,172	20	9,651	-	100.0

1/ The difference between the total of 2,172 thousand acres of Provincial Crown leased land and the 3 million acres quoted in Tables 2-7 and 2-8 is mainly unproductive forest lands.

Source: Company returns, 1966.

In the present study a total of four pulp and paper companies and 29 of the larger sawmilling companies were found to own or control 3.5 million acres, 36 per cent of the productive forest land (Table 2-9). Of this area, 87.6 per cent was in the hands of pulp and paper companies, 12.4 per cent controlled by sawmilling companies.

The area of forest land in large holdings, both freehold and leasehold, controlled by forest-based industries has increased substantially in the past few years and this increase may be expected to continue. Pulp and paper companies typically acquire control of timber stands well in excess of current needs. The main reasons for such "over-holdings" is security. Pulp and paper mills represent large investments which require assured low-cost wood supplies over a long period. If the costs of carrying an excess inventory of wood are low (and they usually are) excess holdings provide the cheapest insurance to cover hazards of fire and disease, underestimations of volume and growth rates, and the potential needs for future expansion. Such excess holdings do, however, result in underutilization of the resource.

Small holdings in Nova Scotia have declined. The area in farm woodlots declined from more than 1.8 million acres in 1951 to less than

1.4 million acres in 1961 (Table 2-9), a reduction averaging 48,300 acres annually throughout the decade. This probably reflects the practice of selling woodlots to sawmill operators for liquidation cutting. In recent years pulp and paper companies have been acquiring these small holdings, either before or after cutting for sawlogs or pulpwood.

Despite this decline, a substantial portion of forest land is still made up of farm woodlots and other small holdings. A special survey 1/ in 1966 revealed that there were 49,500 separate ownerships of wild (forested) land in parcels from 50 to 1,000 acres in extent. Of the owners, 35,700 (72 per cent) were not engaged in agriculture. The average age of owners was 55 years; the average length of tenure, 19 years.

It is probable that most of these parcels are uneconomic. Assuming that the average productivity of a skidder is 1,500 cords per year and that average annual growth per acre is 1/4 cord per year, 6,000 acres would be required to match the productivity of a single skidder. 2/

Timbersheds of Pulp and Paper Companies

Timberland held by the four pulp and paper companies operating in Nova Scotia in 1966 was fairly evenly divided between freehold (53 per cent) and Crown lease (47 per cent) (Table 2-10). The timber volume of all species on these lands was estimated to be over 27 million cords in 1966, about three-fourths softwoods (Table 2-11). A breakdown by species was not available from all companies.

Estimated annual timber cut (1965) and growth on pulp and paper company lands are given in Table 2-12. Again, statistics by species are not available.

1/ Undertaken in conjunction with the annual primary forest production survey by the Department of Lands and Forests.

2/ It should be pointed out that this comparison assumes clear cutting of pulpwood. Neither single-product use, clear cutting as a system of sylviculture, nor use of a conventional skidder is necessarily desirable, let alone optimal, on small woodlots.

TABLE 2-10

Forest Land Holdings of Pulp and Paper Companies, Nova Scotia, 1966

Company	Free-hold	Crown Lease	Present Total	Potential Lease 2/	Potential Total	Present %	Potential %
	-----	-----	000 acres	-----	-----	%	%
Bowaters-Mersey	640	40	680	250	894	22.6	26.0
Minas Basin 1/	366	-	366	-	366	12.2	10.7
Nova Scotia Pulp	6	1,075	1,081	225	1,306	36.0	37.8
Scott (Canadian) 1/	584	296	880	-	880	29.2	25.5
Total	1,596	1,411	3,007	475	3,446	100.0	100.0
Per cent	53	47	100	-	-	-	-

1/ Subsequent to the compilation of this table, Minas Basin Pulp and Power Co. sold 300 thousand acres to Scott (Canadian). (See Financial Post, January 14, 1967.)

2/ Refers to the provision of the 1962 Act for exchanges between Bowaters-Mersey and Nova Scotia Pulp.

Source: Company returns, 1966.

TABLE 2-11

Estimated Timber Volume on Pulp and Paper Company Lands, 1966

Company	Softwoods	Hardwoods	Total	Area	Average Per Acre
	-----	000 cords	-----	000 acres	cords
Bowaters-Mersey	5,461	1,444	6,905	640	10.8
Minas Basin P & P	3,300	1,500	4,800	366 1/	13.1
Nova Scotia Pulp	6,500	3,000	9,500	1,081	8.8
Scott (Canadian)	5,236	924	6,160	880 1/	7.0
Total/Average	20,497	6,868	27,365	2,967	9.2
Provincial Total/Average 2/	54,900	16,500	71,400	9,651	7.4
Pulp and Paper Companies as % of Total	37.3	40.4	38.3	30.7	-

1/ Subsequent to the compilation of this table, Minas Basis Pulp and Power Co. sold 300 thousand acres to Scott Paper Co. (See Financial Post, January 14, 1967.)

2/ Derived from Tables 2-1 and 2-2.

Source: Company returns, 1966.

TABLE 2-12

Estimated Annual Cut and Annual Growth, Pulp and Paper Company Lands, Nova Scotia

Company	Estimated Timber Cut			Total	Est. Annual
	Softwood	Hardwood	Total	Area	Growth/Acre
	-------- 000 cords		------	000 acres	cords
Bowater-Mersey	91.0	3.5	94.5	640	0.16 1/
Minas Basin P & P	5.5	0.0	5.5	366	0.40 2/
Nova Scotia Pulp	108.0	2.0	110.0	1,081	0.20
Scott (Canadian) 3/	(100.0)	(25.0)	(125.0)	880	0.25
Total/Average	304.5	30.5	335.0	2,967	0.23

1/ Based on Continuous Forest Control (C.F.C.) results for 1/6 of area.
2/ Based on 3-per-cent growth rate and estimated timber volume.
3/ Based on requirements of new pulp mill, opening 1967, but excluding anticipated purchases of softwood chips (30 thousand cords-equivalent) and roundwood (130 thousand cords of softwood, 25 thousand cords of hardwood).

Source: Company returns, 1966.

Timbersheds of Large Sawmills

Timbersheds of large sawmills were assessed by making personal visits to 80 per cent of the operators manufacturing over two million feet board measure (f.b.m.) annually. Productive forest land now owned by 29 sawmilling companies was included in Table 2-9 above. A further breakdown is given in Table 2-13A for 23 companies classified by production volume. Estimated landholdings for all 29 companies are given in Table 2-13B.

Table 2-13 reveals that the 29 sawmills cutting over two million f.b.m. annually own a total of 400,000 acres and lease another 34,000 acres. This amounts to only one-eighth of the productive forest land owned or controlled by forest-based industries and 4.5 per cent of the provincial total. Yet, in 1965, these 29 sawmills produced approximately one-half of the total provincial lumber production and converted over one-fifth of the wood removed from Nova Scotia's forests. Thus, underutilization appears to be much less a factor on sawmill holdings than on pulp and paper holdings.

Sub-leases of land for cutting, and agreements to purchase stumpage or logs, are the principal sources of sawtimber supplies for the sawmilling industry.1/ Few operators own more than two years' stumpage supply. Apart from four pulp and paper companies, only three sawmill companies have sufficient sawtimber reserves for more than five years'

1/ Mainly from woodlots. About half of all sawlogs come from woodlots.

operation at their present rate of cutting. Lack of capital for investment in sawtimber not required for immediate cutting and the ready availability, up to the present time, of stumpage or sawlogs delivered to the mill have precluded a build-up of sawtimber reserves by sawmill owners.

With the introduction of two large pulp and paper companies within the past six years, the withdrawal from sale of sawtimber on Crown lands now committed to these pulp and paper companies, and the land-acquisition policy instituted by Scott (Canadian) Ltd., Crown and private timber available for purchase has diminished to the vanishing point.

TABLE 2-13

Forest Land Holdings of Nova Scotia Sawmilling Companies Producing Over 2 Million Board Feet Annually, 1966

A. Actual Land Holdings of 23 Companies

Annual Production	Companies	Free-hold	Crown Lease	Sub-Lease	Total
000,000 f.b.m.	no.	----------- 000 acres			-----------
Over 6	4 1/	284.0	-	-	284.0
3 - 6	8	47.4	0.30	9.1	56.8
2 - 3	11	42.3	3.65	11.2	57.2
Total	23	373.7	3.95	20.3	398.0

B. Estimated Land Holdings of 29 Companies

Over 6	4 1/	284.0	-	-	284.0
3 - 6	11	65.2	0.4	12.5	78.1
2 - 3	14	54.0	4.6	14.3	72.9
Total	29	403.2	5.0	26.8	435.0

1/ Exclusive of Bowaters-Mersey.

Source: Company returns, 1966.

Estimated Volume and Annual Cut

An estimated 145 million board feet of standing timber are owned by three large lumber companies (operating a total of seven sawmills) each of which cuts over 6 million f.b.m. per year. An additional 20 million board feet are owned by six mills cutting from 3 to 6 million f.b.m., and

64 million board feet by nine mills cutting between 2 and 3 million f.b.m. annually (Table 2-14A). Twenty-three of the larger sawmills have under their control some 229 million board feet of sawtimber, an average of about 10 million board feet per mill. At an average annual production of 4.5 million f.b.m., these sawtimber reserves represent only slightly more than a two-year sawlog supply for these larger mills, operating at their 1965 production levels (i.e., at 70 per cent of productive capacity).

In Table 2-14B an attempt has been made to estimate the total sawtimber reserves of all sawmills producing 2 million f.b.m. or more annually. The 370 million board feet they own would supply their mills at 70 per cent of capacity and an annual cut of 130 million f.b.m. for less than three years. (See Table 2-20, p. 2-25.)

Provincial forestry officials point out, however, that this apparent shortage of sawlog supplies is not a new phenomenon. They suggest further that certain mills have recently improved their supply position. Nevertheless, the lack of an assured supply for most producers is a serious obstacle to the stabilization and orderly growth of an efficient lumber industry in Nova Scotia.

Based on the material collected from 23 sawmills during the summer of 1966, it was possible to estimate the annual cut on own holdings for all sawmills producing over 2 million board feet (Table 2-15). The same technique was used to obtain prorated values as in Table 2-14. Only 49 million board feet was actually cut on the sawmill companies' own limits, whereas 62 million board feet of logs (or stumpage) had to be obtained outside their own limits.

TABLE 2-14

Estimated Sawlog Supply Controlled by Sawmills, 1966

A. Estimated Volumes (23 mills)

Annual Production	Total Area	Estimated Volume			Average Volume Per Acre		
		Softwood	Hardwood	Total	Softwood	Hardwood	Total
000,000 f.b.m.	000 acres	000,000 f.b.m.			f.b.m.		
Over 6	226 1/	130.50	14.0	144.50	577	62	639
3 - 6	18	18.40	1.7	20.10	1,022	95	1,117
2 - 3	46	61.85	2.1	63.95	1,346	46	1,392
Total/Average	290	210.75	17.8	228.55	727	61	788

B. Prorated Estimated Volumes (all sawmills) 2/

Over 6	284.0	164	18	182	-	-	-
3 - 6	78.1	80	7	87	-	-	-
2 - 3	72.9	98	3	101	-	-	-
Total	435.0	342	28	370	-	-	-

1/ Exclusive of Bowaters-Mersey.
2/ In the 2 million f.b.m. class and above. Includes sawmills owned by pulp and paper companies.

Source: Company returns, 1966.

TABLE 2-15

Estimated Annual Timber Cut from Own Holdings and Sawlogs Bought, 29 Nova Scotia Sawmilling Companies, 1965

Annual Production	No. of Mills	Total Area	Estimated Cut			Sawlogs Bought	Total Cut
			Soft-wood	Hard-wood	Total		
000,000 f.b.m.	no.	000 acres	------------	000,000 f.b.m.		------------	
Over 6 1/	4	284.0	26.45	1.15	27.60	15.10	42.70
3 - 6	11	78.1	13.82	0.96	14.78	19.73	34.51
2 - 3	14	72.9	6.56	0.51	7.07	26.82	33.89
Total	29	435.0	46.83	2.62	49.45	61.65	111.10

1/ Exclusive of Bowaters-Mersey.

Source: Company returns, 1966.

Estimated Annual Growth

The total annual growth on the holdings of the sawmills is estimated to be 9 million board feet, when using Von Mantel's formula (=growing stock/half the rotation age) (Table 2-16). This formula, used by the Nova Scotia Department of Lands and Forests, seems to be extremely conservative. Estimates by forest land holders centre around 100 board feet per acre per year, which results in an estimated total annual growth of 43.5 million board feet on the holdings of sawmills. This approaches the total annual cut from their holdings. One land owner estimates growth at 250 f.b.m. per acre per year.

Other Crown Lands

Unoccupied Crown land comprises 702,000 acres of productive forest land as well as 20,000 acres of Federal Crown land. Although no information is available about the amount of wood standing, the volume of merchantable wood on the 722,000 acres is estimated to be 5 million cords (using an average of 7 cords per acre). It should be mentioned, however, that the land is distributed in small areas throughout the province.

Other Private Holdings

Private holdings, other than the forests owned by the pulp and paper industry and the sawmills, consist of 1.4 million acres of farm woodlots and 4.0 million acres of assorted private holdings. The 1958 forest inventory came to the conclusion that smaller holdings, particularly, have been heavily exploited, and noted that the quality of the stands is low. By deduction, the amount of merchantable wood is estimated to be 38 million cords. About half the annual cut of pulpwood comes from these

sources (370,000 cords) as well as a considerable volume of sawlogs (95 million board feet).

TABLE 2-16

Estimated Annual Growth of Sawlogs on Own Holdings, 29 Nova Scotia Sawmilling Companies, 1965

Annual Production	Estimated Volumes 1/			Estimated Annual Growth 2/			Total Area	Estimated Total Annual Growth 3/
	Softwood	Hardwood	Total	Softwood	Hardwood	Total		
	000,000 f.b.m.						000 acres	000,000 f.b.m.
Over 6 4/	164	18	182	4.10	0.36	4.46	284.0	28.4
3 - 6	80	7	87	2.00	0.14	2.14	78.1	7.8
2 - 3	98	3	101	2.45	0.06	2.51	72.9	7.3
Total	342	28	370	8.55	0.56	9.11	435.0	43.5

1/ *See* Table 2-14B.
2/ Von Mantel's formula.
3/ Estimate based on growth of 100 board feet per acre per year.
4/ Exclusive of Bowaters-Mersey.

Source: Company returns, 1966.

Impact of Tenure on Forest Management

Leasing of Crown Lands or Cutting Rights. Three long-term leases of Crown land are still in good standing - one of them expires in 1969. The Lands and Forests Act does not specifically require that lessees submit management plans, nor does it specify the conditions under which timber cutting licences are issued. However, existing agreements with Scott (Maritimes) Ltd. and with Nova Scotia Pulp Ltd. contain provisions for management plans. Moreover, there are indications that both the Nova Scotia Department of Lands and Forests and the holders of leasehold lands recognize the need for the lessee to become increasingly involved in the management of the land under his control.

Ownership. Encouragement of sound forest management on freehold land, especially on small holdings, is one of the responsibilities of the extension forester. Woodlots are potentially the most productive forestlands but their actual average productivity is, in fact, declining. By virtue of accessibility, favourable topography and proximity to land in agricultural use, farm woodlots are most susceptible to the application of intensive forestry practices. However, scarcity of readily available sawlogs to supply the needs of the many small sawmills leads to liquidation of most timber stands containing trees of sawlog size. Because of the declining sawlog supply, some freehold land is held as a reserve by saw-

mills, and stumpage or logs are purchased to satisfy current input requirements. This practice is expected to continue until the available supply from such sources is exhausted.

Difficulty of Establishing Ownership. In order to concentrate good forest land into parcels amenable to sound forest management, it is first necessary to be able to identify the owner of any given parcel. Today that is often difficult to do. Deeds to some properties are not registered in local tax assessment offices; boundaries are often difficult to locate in the field. This is particularly true on Cape Breton Island. Such conditions have an adverse effect on forestry practices.

3. PULP AND PAPER

Five pulp and paper mills were operating in Nova Scotia in 1967. 1/ Well distributed throughout the province, all are located on seaboard (see Map 5). Information concerning the size, type, capacity and output of the five mills is summarized in Table 2-17.

It is estimated that the total capital invested in the industry is $184.3 million, or approximately $91,000 per employee. The total values of shipments in 1963 and 1964 (four mills) were, respectively, $34.5 and $40.8 million.

Including the mill at Abercrombie, the total amount of wood required annually is 790,000 cords, nearly twice as much as the total pulpwood production in the early 1960's. However, 15 per cent will be in the form of pulp chips, purchased from sawmills. The hardwood consumption is 30,000 cords from own limits and 25,000 cords purchased.

TABLE 2-17

Pulp and Paper Mills, Nova Scotia, 1965

Location	Type of Mill	Capacity Day	Capacity Year	Capital Value	Limit Wood	Purchase Chips	Purchase Round-wood	Plant Labour Force	Output Vol.	Output Value	Daily Output
		tons	000 tons	million $	000 cords	000 units	000 cords	no.	000 tons	million $	ton/man
Liverpool	Newsprint	500	180.0	50.0	58	80	-	800	158.0	25.0	0.625
	Groundwood	-	-	-	-	-	-	-	-	-	-
	Sulphite	-	-	-	-	-	-	-	-	-	-
Hantsport	Groundwood	100	33.0	1.3	1/	-	1/	157	33.0	2.0	0.640
	Paperboard	40	12.0	1.7	1/	-	1/	75	12.0	1.6	0.530
Mill total		140	45.0	3.0	6	-	38	232	45.0	3.6	0.600
Port-Hawkesbury, C.B.I.	Bleached Sulphite	350	130.0	50.0	110	10	150	300	130.0	17.0	1.160
Scott mills		600	176.5	51.3	137	30	170	604	176.5	22.1	-
Sheet Hbr.	Groundwood	100	26.5	1.3	12	-	15	104	26.5	1.6	0.960
Abercrombie	Sulphate	500	150.0	50.0	125	30	155	500	150.0	20.5	1.000
Total		1,590	531.5	184.3	311	120	358	1,936	509.5	69.3	-

1/ Wood utilization available only as a mill total.
2/ Expected values.

Source: Company returns, 1966.

1/ Including the new kraft mill in Abercrombie, Pictou County. Although this survey was prepared before the opening of that mill, known information has been included in this section.

Plant Labour Force

With the start-up of the new kraft mill at Abercrombie, the total labour force will near 2,000 (see Table 2-17).

The entire labour force of production workers is organized, and collective agreements are in force between the companies and the International Brotherhood of Pulp, Sulphite and Paper Mill Workers, the United Paper Makers and Paper Workers, as well as the International Brotherhood of Electrical Workers.

Hourly wage rates in 1965 are summarized in Table 2-18.

TABLE 2-18

Hourly Wages, Pulp and Paper Industry, Nova Scotia, 1965

Company	Range	Average
	$	$
Bowaters-Mersey	2.48 - 5.62	2.68
Minas Basin	1.60 - 2.50	-
Nova Scotia Pulp	2.30 - 3.48	-
Scott (Sheet Harbour)	-	1.49

Source: Collective bargaining agreements where available.

Labourers are full-time employees and work 40 hours per week. In 1965, monthly employment ranged from 1,529 to 1,686 (D.B.S.). In previous years, this range was greater.

One indicator of labour productivity is shown in Table 2-17. Depending on the age of the mill, product mix and other factors, output per man per day ranges from 0.53 to 1.16 tons.

Wood Utilization

On a world basis, conversion factors show a tendency for increased efficiency in wood utilization. From 1950 to 1964, the roundwood equivalent of one metric ton of mechanical pulp decreased from 90 to 88 cubic feet, all chemical pulps combined showed a decrease from 178 to 173 cubic feet per ton and newsprint from 106 to 99 cubic feet per ton. It is doubtful whether this tendency will continue. (F.A.O., 1950, 1964.)

The bleached sulphite process used by Nova Scotia Pulp requires 176 cubic feet of roundwood equivalent per ton of pulp (= 2.1 cords). A similar rate of utilization is expected from Scott's new kraft mill.

There is some potential for increased utilization of hardwoods. Scott reported that it planned to use 50,000 cords of hardwoods annually in its Abercrombie kraft mill, 25,000 cords to be cut from its own limits and 25,000 to be purchased. This is in accordance with Section II, Statutes of Nova Scotia, 1965, Ch. 15 (Scott Maritimes Pulp Limited Agreement Act, 1965), which states in part:

> "whereas the Mill will require a minimum of 400,000 cords of wood annually"; and "approximately fifteen per cent of the pulpwood used in the Mill will be hardwood."

In discussions on this report, it was suggested that the hardwood cut for the Abercrombie mill could be increased beyond the minimum 15 per cent requirement. In other pulp mills in the province, any potential increase in the use of hardwoods is at present undefinable.

4. SAWMILLS

The revised standard industrial classification by D.B.S. lists about 250 active sawmills in Nova Scotia producing 100,000 board feet of lumber or more annually. (See Map 6.) The present report concerns itself only with those mills producing more than 2 million board feet per year. Of 31 mills in that class, 23 have been visited. Inferences are made from the 23 mills about all 31 mills, and, at times, about all sawmills.

Distributed throughout the province are five companies, most of them consisting of more than one sawmill and one of them owned by a pulpmill, producing over 6 million board feet of lumber per year; 11 sawmills produce between 3 and 6 million board feet and 15 produce between 2 and 3 million board feet. Together, these 31 mills produce about 50 per cent of the total provincial lumber output. (See Table 2-19.)

The value of the equipment installed ranges from $5,000 to $400,000 per sawmill. Of the 23 mills visited, 19 have a chipper and debarker. Of the remaining four mills, one has a debarker. Fifteen mills have a planing mill as well. The estimated capital invested in the 31 sawmills is $3.5 million. This would suggest that the total capital invested in equipment for the entire sawmill industry is about $5 million. For the sawmills visited, the average capital value installed per employee was $4,600.

Sawmill products are the usual assortments of rough and dressed lumber, railroad ties, laths, box shooks, spool wood, shingles and other products. An important by-product is chips for pulping. Much custom-sawing is done to individual specifications.

In Table 2-19 no allowance is made for over-run (New Brunswick Log Rule), so that input in board feet equals output. Clearly indicated in the table is the tendency for the larger mills to supply their own sawlogs and to have arrangements with the pulp industry to cut logs from their holdings. Smaller mills depend more on purchased logs from farm woodlots and other private holdings.

Labour Force

Employees of the sawmill industry in Nova Scotia are, as a rule, not organized in labour unions. Sawmill employment fluctuates more during the year than employment in the pulp industry. The present tendency is for more capital to be invested at the expense of labour, but, as a concomitant, the remaining labour force is employed for a longer period each year. Employment has decreased from 2,500 men in 1947 to about 1,300 in 1966 (D.B.S.). Insufficient information is available, however, to include an occupational breakdown. Pay rates vary considerably, but range between $0.90 and $2.50 per hour. Work periods vary from 5 to 12 months; averages are given in Table 2-20. As a rule, the daily work period is nine hours. Only one mill works a night shift.

TABLE 2-19

Nova Scotia Sawmills 1/ with Annual Production of 2 Million F.B.M. or Greater, 1965

Annual Mill Production	Capacity	Production	Production as % of Capacity 2/	Capital Value	Sawlog Inputs			Source of Sawlogs		
					Softwood	Hardwood	Total 3/	Own Limits	P & P Co.'s	Purchased
---------- 000,000 f.b.m.		----------	%	$ 000	----------------		000,000 f.b.m.		----------------	
Over 6	80.3	56.8	70	1,200	55.8	1.0	56.8	21.8	28.1	6.9
3 - 6	51.4	37.1	72	1,200	35.7	1.4	37.1	14.7	7.0	15.4
2 - 3	57.0	36.4	63	1,100	36.0	0.4	36.4	6.8	1.6	28.0
Total	188.7	130.3	69	3,500	127.5	2.8	130.3	43.3	36.7	50.3

1/ Prorated, based on sample of 23 mills.
2/ Production in relation to capacity is influenced by the shortage of sawlogs, small log size and winter weather conditions.
3/ The balance of the total volume of lumber cut in 1965, 238 million f.b.m. (see Table 2-23), was produced in the 379 sawmills, active in 1965, that cut less than 2 million f.b.m.

Source: Company returns, 1966.

TABLE 2-20

Labour Force, Average Work Periods, Wages and Productivity, Nova Scotia Sawmills, 1965 1/

Annual Production	Labour Force	Work Period	Range	Hourly Wages		Output Per Man		
				Average	Sawyer	Per Day	Per 10 Months	Per 12 Months
000,000 f.b.m.	no.	mo.	$	$	$	f.b.m.	000 f.b.m.	000 f.b.m.
Over 6	209	10	1.05 - 2.15	1.33	2.00	1,310	325	270
3 - 6	245	10	0.90 - 2.25	1.32	1.93	970	180	151
2 - 3	303	10	0.90 - 2.50	1.34	1.70	720	144	120

1/ Prorated, based on sample of 23 mills.

Source: Company returns, 1966.

Labour Productivity

Indices of productivity are difficult to establish. The output per man-day indicated in Table 2-20 should only be considered as a guide. Much depends on the activity of the sawmill. As a rule, the addition of a planing mill will decrease the output per man-day in a sawmill by half. On the basis of a 10-month work year, the average total output per man-year for the three groups of sawmills is 325, 180 and 144 thousand board feet. This compares with an estimated average over-all of 187 thousand board feet per man-year.

Type and Value of Additional Input

Additional inputs consist mainly of fuel and electricity. D.B.S. shows a cost of fuel and electricity of $511,000 in 1965, $62,000 more than in 1964. Production increased, however, by 6 per cent. Estimates of costs for electricity range between $1,000 and $2,000 per month for the largest sawmills, between $200 and $700 per month for the medium-sized mills, and between $200 and $600 per month for the mills producing between 2 and 3 million board feet annually.

Volume and Value of Output

The total volume and value of output for the last six years is presented in Table 2-21. The values include the production of pulp chips, which currently is about 80,000 oven-dry tons. The total sales value of the chips is about $1.3 million.

Quality Control and Marketing

There is lack of agreement among those engaged in the sawmill industry concerning the desirability of a common lumber-selling agency. As long as present grading specifications do not adequately take care of quality differences, a single selling agency is not considered practical. Progress toward this is also hindered by a multiplicity of small mills.

Although representatives of both the Nova Scotia Forest Products Association and the now-defunct Nova Scotia Woodlot Owners' Association have expressed a desire for a common marketing agency to handle both export and domestic lumber shipments, the lumber industry does not seem to be prepared for such a move. As a consequence it may be ill-prepared to withstand the increased competition on the United Kingdom market that is expected to result from the new bulk-handling and merchandising methods of British Columbia producers.

TABLE 2-21

Volume and Value of Output, All Sawmills, Nova Scotia, 1960-1967

Year	Volume	Value
	million f.b.m.	$ 000
1960	232	11,942
1961	245	11,568
1962	228	12,832
1963	241	13,788
1964	232	13,060
1965	238	13,844
1966	267	13,531 1/
1967	231	13,436 1/

1/ Based on 1965 constant dollars.

Source: Sawmills; Monthly Bulletins. D.B.S.

Transportation Problems

Weight restrictions on provincial roads are considered to be a major problem for both lumber and chip transportation. In particular, the weight of chips is difficult to estimate because of varying moisture content.

Rail shipments of lumber to the Montreal market are somewhat hampered by high freight rates. Railroad cars especially designed for wood and lumber transport are very scarce in the Maritime Provinces. A further complaint is about charges levied on private railroad sidings.

Freight rates for lumber shipments overseas are high relative to the price of lumber and ranged in 1966 from $74.50 per standard (1,980 board feet) for individual boards to $66.50 for lumber packaged and buttoned on two ends. In 1967, freight rates increased by $5 per standard. The Maritime Lumber Bureau is in favour of chartering tramp freighters. Supporters believe a common selling agency could improve efficiency in packaging lumber, thus qualifying for more attractive freight rates.

Technological Trends and Possibilities

Before advantage can be taken of improved technology, the problem of the sawlog supply must be solved. This is of overriding importance and already an acute problem for some, if not most, sawmills.

Provided that this problem is solved, a few technical innovations can still be made in this traditional industry. An important by-product of the sawmill industry is chips for pulping. Started in 1958, the sawmill-chip industry produced 50,000 tons in 1962, 60,000 tons in 1963, increasing steadily to 89,000 tons in 1966. It is estimated that the potential capacity of chip production by sawmills is 150,000 tons, and that, at present, the economical production of chips is restricted to mills producing two million board feet or more annually. Potential utilization of chips by the pulp industry is believed to be about 120,000 tons annually. Capital investment is about $20,000 for the installation of a debarker and chipper.

Although sawdust is now being used for fine papers in British Columbia and the southern United States, there appears to be no similar potential in eastern Canada. The larger kerf used in cutting large British Columbia logs makes sawdust of small chip size. Sawdust produced in eastern mills is extremely fine and therefore difficult to utilize in paper production.

With an adequate sawlog supply, some mills could profitably install hot-ponds to allow a longer operating period and greater stability of production and employment.

Other Forest Products

At present, no manufacture of plywood or veneer takes place in Nova Scotia. Plywood manufacture in eastern Canada makes use of poplar species, mostly trembling aspen and large-tooth aspen. The gross volume of both species is estimated to be 108 million cubic feet and is restricted to Cape Breton Island, the Counties of Kings and Lunenburg, and the counties west of these two. The merchantable volume is 54 million board feet and entirely restricted to the western part of the provinces. However, a hardboard plant in Lunenburg County, Anil Canada Ltd., will soon be using 50,000 cords of wood, including 18,000 cords of poplar, and plans eventually to expand its operations to three times its initial output. The 18,000 cords of poplar represents 16 per cent of the total of present estimates of merchantable volume. It seems, therefore, that for the time being, no poplar plywood manufacture can occur in Nova Scotia since the remaining percentage of hardwood volume would be insufficient to support a plywood enterprise.

The Anil plant, located at East River, near Chester, will produce a standard hardboard product from a variety of wood species. Initially, hardwoods will provide the major input. The plant cost about $8.5 million to construct and employs a labour force of 150 to 200 men.

Apart from Anil, all significant processors of forest products in Nova Scotia are included in the pulp and paper and sawmill industries.

5. INSTITUTIONAL FACTORS

Provincial Taxation, Stumpage and Royalties

All freehold forest land in holdings exceeding 1,000 acres in area is subject to an annual provincial land tax of one per cent of the assessed value. In addition, occupied forest land in lots of 200 acres or more is subject to a provincial fire tax of $0.75 per 100 acres. The revenue from land tax in 1965 amounted to $64,000; an additional $31,000 accrued from the fire tax. In total, this amounts to less than one mill of the total provincial revenue.

On two long-term Crown leases no ground rent is paid, but variable royalty rates are charged. The arrangements are negotiable after ten years. A lease held by Bowaters-Mersey expires in 1969 and at present the company is in the process of exchanging its freehold for other Crown properties in order to consolidate its holdings. Nova Scotia Pulp's lease, which commenced in 1958, is on the basis of $1.00 per cord for the first ten years, $1.75 per cord for the next ten years, and $3.06 per cord for the next decade, and after that is subject to negotiation. Moreover, no ground rental is charged. The lease held by Scott (Maritimes) is also on a stumpage basis, at a rate of $2.00 per cord for the first ten years, then subject to negotiation, but in no case to be less than $2.00 per cord.

In contrast to the long-term leases granted to pulp and paper companies, sawmilling companies dependent upon Crown timber must rely upon short-term government timber sales. These are usually for two-year terms, but are renewable if the timber specified for removal has not been cut within the period stipulated in the initial contract. Stumpage rates appear to have changed little over the last ten-year period; depending on the county, stumpage rates for pulpwood range from $2.50 to $5.00 per unpeeled cord. 1/ Stumpage for sawlogs ranges between $10.00 and $18.00 per thousand board feet for softwood, and between $6.00 and $40.00 per thousand for hardwood.

In general, provincial taxation of forest land is considered to exert an insignificant effect on either the use of such land or on the provincial economy. However, the current policy of timber-land acquisition of Scott (Maritimes) Ltd. has tended to increase land (and timber) prices. A review of provincial policy with respect to taxation, stumpage and royalties is deemed desirable. 2/

1/ MacSween (1964) presented evidence of actual cost per cord of pulpwood which left only 57 cents for stumpage, assuming a labour wage of 90 cents per hour.

2/ The Majority Report of the Municipal Forest Taxation Committee, submitted to the Nova Scotia Voluntary Planning Board in March, 1967, recommended that both the provincial land tax and fire tax be rescinded and that they be replaced with a forest-yield tax.

Municipal Taxation

Property taxes, consisting of a municipal tax and a school tax, are levied on all leased or licensed Crown and private land. Nova Scotia is believed to be the only province in which municipalities may levy taxes on leased Crown land. 1/ The land and timber are both assessed at market value. This assessment and taxation give rise to many inequalities among the 24 municipalities. In Table 2-22 the extremes of these municipal assessments and taxes are illustrated.

TABLE 2-22

Range of Municipal Assessments and Taxes Per Acre, Nova Scotia, 1956

Land Class	Assessment		Tax	
	Minimum	Maximum	Minimum	Maximum
Cultivated	$ 1.00	$ 37.50	$ 0.22	$ 2.38
Pasture	1.00	15.00	0.09	0.75
Timber I	1.00	60.00	0.05	1.26
Timber II	1.00	30.00	0.05	0.63
Woodlots	1.00	7.50	0.05	0.18
Cut-over	nil	6.75	0.02	0.32
Waste	nil	1.00	nil	0.13

Source: Moore, A.M. Forestry tenures and taxes in Canada. Canadian Tax Foundation, Toronto, 1957. p. 157, 158. Although the data refer to 1956, the range of assessments and taxes was fully as great in 1966.

The present assessment of forest lands does not readily permit a reliable estimate of the municipal revenue derived from the taxation of forest land. Estimates range from eight per cent in the Municipality of Barrington to 40 per cent in St. Mary's. In the counties with relatively large quantities of forest land, the percentage of municipal revenue from forest taxation may be over 25 per cent. (Johnson, 1961.) The total revenue from forest property taxes was $828,000 in 1963.

1/ In addition, the municipalities in which the provincial government issues licences to cut timber from Crown land receive 15 per cent of the stumpage. This, however, amounts to little and ranged in 1965 from $32 in the Municipality of Barrington to $1,978 in the Municipality of Halifax. In 1965, the total amount paid to municipalities under this arrangement was $9,195.

It is generally conceded that the weight of these taxes is far too heavy, and inhibits good forestry practices. Only the best of sites, e.g., old farm land with a mean annual increment of over 0.5 cord per acre, are sufficiently productive to be able to bear these municipal taxes. This excludes most of the actual timber land in the province. By any reasonable standard, the municipal tax burden is out of proportion to the financial yield to the property owner. The effect, especially in certain municipalities, is that small woodlot holders tend to clear the timber from the land and let it revert to the Crown, where it becomes exempt from municipal taxation. The tax burden, however, becomes proportionately higher on the remaining forest holdings. There are municipalities where the tax rate is so high that the taxes, capitalized over the rotation period at an interest rate of five per cent, are higher than the value of the crop at maturity (Johnson, 1961). The result is that either very short rotations tend to be adopted or the title of the land, after removal of the timber, will be assumed by the Crown, or, more recently, by one or other of the pulp and paper companies.

Instead of the property tax now in use, Johnson (1961) proposed:

1) Taxation based on assessment of productive capacity. This is a good forest tax, but difficult to calculate, requiring reliable property maps, as well as maps showing a reasonably accurate classification of productive capacity.

2) A forest-yield tax. This system imposes a tax when the timber is cut and is therefore good for small woodlots. The forest land, without the timber, remains subject to a bare-land tax.

Because of the difficulty of administering the first system, particularly in obtaining the necessary maps either now or in the near future, the forest-yield tax appears preferable. Johnson recommended that the yield tax be paid at the rate of ten per cent of the stumpage value at the time of cutting on all forest products except those cut for domestic use by the owner. The annual land tax on commercial forest properties, including farm woodlots, would be paid on the basis of a uniform assessment of $1.00 per acre.

At meetings of the Advisory Committee on this study held in 1967, there was considerable discussion of the role of provincial and municipal taxation on forestry. Dr. I.C.M. Place, noted the applicability of ground rent as a tool for increasing productivity when it was related to the capability of the land for forest production. He suggested that the Canada Land Inventory mapping could be used for this purpose. Although others suggested that the scale of the inventory mapping program was too small to establish productivity ratings for small blocks, Dr. Place pointed out that the original work sheets were to the scale of four inches to the mile and that, at this scale, coverage should be sufficiently accurate to enable this type of assessment to be undertaken.

Also in 1967, a report of the Municipal Forest Taxation Committee submitted to the Nova Scotia Voluntary Planning Board, contained

the following recommendation:

> "Whereas there are certain basic features of the ad valorem property tax and its administration in Nova Scotia that are unfair to forest property owners; and whereas a forest-yield tax that places the major portion of taxation weight at a time when there is income derived from a forest property is a more just and fair system of taxation; the majority of the Committee recommends the adoption of the mandatory forest-yield tax . . . in the Province of Nova Scotia."

A mandatory forest-yield tax has been in effect and operating effectively in the State of New Hampshire since 1949. Introduction of a similar tax in the Province of Nova Scotia has been studied and is deemed to be feasible. It is recognized that a forest-yield tax, unlike the property tax, would require provincial rather than municipal administration and that its adoption would affect the distribution of revenues between the two levels of government.

6. CONCLUSIONS

A number of studies - Hawboldt and Bulmer (1958), Johnson (1961), MacSween (1964) and the Nova Scotia Voluntary Planning Board (1966) - have contained important findings which are still relevant to the orderly development of Nova Scotia's forestry resource. They should be considered in conjunction with the conclusions stated here.

Although the 1958 forest inventory remains the basic reference on the forest resource, a 1964 review of softwood volumes by a Cabinet committee, and a current review by Ker reported in this study, provide some updated inventory estimates. Moreover, results of the re-inventory, to be completed in 1972, are now becoming available.

However, the lack of accurate, detailed knowledge about growth rates related to species, soils and locations is a serious deterrent to improving forest management in Nova Scotia. As well, it makes difficult an orderly and equitable allocation of resources and the rationalization of forest-based industries. A particular need is a study to accurately determine per-acre growth rates in cubic feet and in feet board measure by site class and for administrative divisions. Growth estimates thus obtained would permit more accurate assessment of annual sustained yield potential.

Most forest land in Nova Scotia is privately owned (73 per cent); Crown land under lease constitutes only eight per cent. Much of the privately owned land is distributed among nearly 50,000 ownerships ranging from 50 to 1,000 acres in size. Thus, although private lands generally offer the best potential for economic forest management, the diffusion of ownership in many small parcels makes institution of progressive management practices extremely difficult. Many smaller holdings have been heavily exploited; the quality of stands is low, and the productivity in many cases is declining.

At the other extreme, four pulp and paper companies own or control more than 30 per cent of productive forest land containing 38 per cent of the province's timber volume. The trend is toward greater consolidation of larger holdings with attendant underutilization of the resource. Means do not now exist to ensure scientific forest management of a pulp company's total holdings, including privately owned land.

Another factor affecting forest management is the municipal tax structure, which falls inequitably and heavily upon owners. It encourages either very short rotations, or liquidation cutting followed by sale of the property or its reversion to the Crown.

In the disposal of tax-sale land, the province plays essentially a passive role - that is, it purchases the land only if no other bidder appears. By adopting this somewhat haphazard approach, the province misses an opportunity to (1) play an active role in consolidating small holdings and (2) demonstrate the value of prompt reforestation and efficient management.

There is little evidence that the Crown has consciously used timber available for cutting on its unallocated lands for the purpose either of stabilizing supply for local woods-product industries or of integrating utilization of the forest crop on Crown lands. Large Crown leaseholds have frequently been allocated to single-purpose users, such as pulp mills, located some distance from the timber.

Much remains to be done before full use of Nova Scotia's wood resource is achieved. Single-use cutting is still prevalent. Although utilization of pulp chips is increasing, many sawmills are too small to afford or make use of debarkers and chippers.

Hardwood is relatively underutilized, although consumption is now expected to increase considerably with the completion of the new conversion plants of Scott (Maritimes) and Anil Canada Ltd. Additional utilization merits study. Most of the province's hardwoods appear to be of relatively low quality and suitable only for pulpwood, fuelwood and the manufacture of hardboard. Because of their low quality and value, utilizable hardwood should be harvested with the cutting of softwoods in order to reduce, rather than increase, the hardwood component of Nova Scotia's forest cover.

Sawmilling is declining relatively because neither private nor public policies in the past have ensured a continuous raw-material supply. Lacking more research and analysis concerning the future role of sawmilling in Nova Scotia, the industry must proceed uncertainly and the government will continue to be hampered in designing policies and incentives appropriate to optimum long-term management of forest resources.

Whether or not aggregate utilization of softwood is approaching its limits is unclear. There is no doubt that past estimates of volume and growth were extremely conservative. Steps were taken in 1964 to correct this by increasing the annual allowable cut of softwoods by 70 per cent. Some evidence suggests that this too is less than the actual yield under present conditions of forest management. If so, there is a significant level of underutilization of the softwood resource.

APPENDIX

DESCRIPTION OF RE-INVENTORY VOLUME ESTIMATES

Hawboldt (in a letter to Ker) described the volume estimates to be obtained in the current re-inventory as follows:

These volumes will be presented in tabular form at the Municipality level by ownership class, species, stand size class, site class, density class, and age class.

Each subdivision inventory summary report will include a table showing the growing stock expressed as equivalent volumes for:

1) Merchantable (gross) volume in cubic feet.

2) Merchantable (gross) cordwood volume if cut into four-foot bolts.

3) Merchantable (gross) cordwood volume if cut into eight-foot bolts.

4) Merchantable (gross) volume f.b.m.

This is an interpretation of the basic growing stock volumes converted from cubic feet to cords and f.b.m. with the method of conversion or factors shown in each inventory report.

The new volume estimates are believed to be superior to the 1955 inventory for the following reasons:

1) The tree-volume estimates are being computed by using a tree-volume equation developed by T. Honer, Department of Forestry and Rural Development, Ottawa, Ontario. This equation is modified for each species (white spruce, balsam fir) and species groups by using constants developed by Honer. In the 1955 inventory, the "Nova Scotia Height-Class Volume Tables for Individual Trees - Softwood Species" were used for <u>all</u> softwood, hardwood species. While the formula and tables agree within one to three per cent for the softwood species, the tables give volume estimates that are approximately ten per cent high for the hardwood species. It is believed that the new inventory volume formula gives more accurate volume results by species and/or species groups.

2) The method used in applying the volume tables in 1955 is now believed to have provided estimates that were slightly high. The sample trees taken in 1955 were from the dominant and co-dominant crown classes. This factor alone would make the volume estimates in 1955 high.

At that time weighted averages of the heights and diameters measured on the sample trees (approximately four trees) were determined for each plot. This average height and diameter were then used to decide the height-class volume table to be used in working up the sample plot volumes. The nearest height-class table was then used for working up plot volumes.

The heights and diameters of the sample trees measured in 1965 and occurring in a subdivision were used to plot height-diameter curves. From these smoothed curves, a local volume table was prepared for the subdivision using Honer's tree-volume equation. Stock tables were prepared by applying the 1965 local volume table to the 1955 inventory stand table for some of the common 1955 inventory strata.

On comparing the reworked stock tables to the original (1955) stock tables, it was found that the softwood volumes were ten per cent lower in the former and the hardwood volumes twenty per cent lower in the former. The same results were obtained in one other subdivision. Ten per cent of the hardwood volume difference is already accounted for by using different volume tables. The reason for the ten per cent difference for both softwood and hardwood is due to the use of different volume tables, based on sample trees taken at a later date, and a different method of entering the tables. While it may be debated that the volume estimates developed in this manner are still not being made comparable to the 1965 volume estimates, because the 1955 sample trees were not used to develop local volume tables from Honer's tree-volume equations, we believe that this is an indication that the 1955 estimates are high compared to the 1965 inventory.

3) In addition:

(1) The volume estimates in 1965 are applicable to a Municipality, while in 1955 it was a subdivision, even though estimates were presented by County.

(2) The volumes are being classified into finer classes, e.g., ownership, site, and age classes.

(3) The typing on the maps is being done with greater precision and the resultant forest-type maps are proving to be more useful to the forest land manager.

4) The 1955 basic inventory expressed volumes as:

(1) Total cubic-foot stem volume, including bark,

excluding stump, for living trees equal or greater than four inches (3.6" +) d.b.h. over bark to the tip of the tree based on the "Nova Scotia Height-Class Volume Tables for Individual Trees - Softwood Species" for both hardwood and softwood species.

(2) The sawlog volume:

(a) Softwoods

The volume in f.b.m. (New Brunswick Log Rule) for all living trees equal to or greater than eight inches (7.6" +) d.b.h. over bark to an approximate six-inch minimum top, over bark, based on the same tables as (1) above.

(b) Hardwoods

The volume in f.b.m. (New Brunswick Log Rule) for living trees equal to or greater than ten inches (9.6" +) d.b.h. over bark to an approximate six-inch minimum top, over bark, which cruisers estimated contained at least one log. A separate tally was made in the field and the cruisers recorded the number of logs by d.b.h. and species. The Federal Form-Class Tables were then used to obtain the taper and resultant small-end diameter. The volume was then determined directly from the New Brunswick Log Rule.

The above basic volumes were then converted to net merchantable volumes by the factors shown in the 1958 Forest Inventory Report. These factors included reductions for tops, cull, non-operable areas, and then converted to cords in the case of pulpwood and just reductions for non-operable areas and cull in the case of sawlogs.

The cubic-foot and f.b.m. estimates are of the same growing stock except that there would be no f.b.m. estimates of the trees contained in the four to seven-inch softwood d.b.h. classes, nor in the four to nine-inch hardwood d.b.h. classes.

It can be seen that any attempt to relate board foot-cubic foot ratios for the hardwood estimates of equivalent growing stock would be meaningless because so little of this volume is suitable for sawlogs.

The 1965 and later subdivision inventories will not attempt to convert the basic cubic-foot volumes according to particular commodities because it would be too difficult to consider all the factors involved in such an assessment. The subdivision summary reports will present an interpretation at the gross merchantable level for four-foot, eight-foot, and f.b.m. estimates.

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FORESTRY
in the
ATLANTIC PROVINCES

PART THREE

NEW BRUNSWICK

PART THREE
TABLES

PART THREE
TABLES

FORESTRY IN THE ATLANTIC PROVINCES

PART THREE: NEW BRUNSWICK

1. NATURE AND DISTRIBUTION OF RESOURCE BASE

Land Capability Classes

A survey of forest-land capability has been undertaken under the Agricultural Rehabilitation and Development Administration (ARDA) as a part of the Canada Land Inventory. This program, scheduled for completion in 1970, will provide a land-capability classification for forestry covering most of the land area of the province. Land is being classified into seven categories based on mean annual wood-volume growth in natural forest stands. Factors limiting tree growth will be indicated for each category.

Over 86 per cent of New Brunswick's land area is productive forest land (Table 3-1). The settled land areas, amounting to 8.4 per cent, are confined mainly to the coasts, the Saint John River Valley and the south-eastern lowlands.

Stocked productive forest land is defined as supporting tree growth more than 10 feet in height and covering more than five per cent of the ground. Unstocked forest land comprises recent clear-cut or burned areas or old fields returning to forest. This should not be confused with unforested waste land which comprises muskegs, rock barrens, beaches and natural meadows, or with non-productive forest land which has some tree cover but is not capable of producing a stocked forest. Both of these classes, fortunately small in extent, present little opportunity for any economically feasible treatment to bring them into forest production. On the other hand, the unstocked forest land, amounting to about 10 per cent 1/ of productive forest land, may be considered a prime area for sylvicultural management.

Wright (1966) has stated it thus:

> "The millions of acres of non-stocked and poorly stocked lands in Canada comprise a critical problem which must be attacked by the combined forces of the Federal and Provincial Governments and the forest industry. There is no area in forestry which provides a greater opportunity for co-operative effort. The end result of effective action can only be increased prosperity for the entire community."

1/ Provincial authorities point out that in New Brunswick "unstocked" land "comprises recent clear cuts or burned areas or old fields returning to forest." Because much such land restocks naturally, they believe that much less than 10 per cent of the unstocked area requires restocking by artificial means.

TABLE 3-1

Land Area Classified by Condition Class,

New Brunswick and Other Atlantic Provinces, 1962

Condition Class	New Brunswick		Other Atlantic Provinces	
	000 acres	%	000 acres	%
Cultivated or occupied	1,480	8.4	2,350	2.2
Productive forest land	15,288	86.5	31,843	30.0
Stocked	13,707	78.0	29,831	28.1
Unstocked	1,581	8.5	2,012	1.9
Non-productive forest land	283	1.6	35,357	33.4
Total forest land	15,571	88.1	67,200	63.4
Waste land	764	3.5	36,454	34.4
Total land area	17,815	100.0	106,004	100.0

Source: Canadian Forestry Statistics, 1962. D.B.S.; Census of Canada, 1961.

Estimated Wood Volume 1/ by Forest District

Table 3-2 is a summary of pertinent data from the New Brunswick forest inventory (New Brunswick, 1958) by forest district. 2/ A re-inventory, to be completed in 1970, will provide wood volume and growth estimates by Site District (Loucks, 1962).

Although age-group summaries are not available, New Brunswick forests have been classified by Maturity Groups, defined as follows (New Brunswick, 1958):

Group I - volume estimated to be 1,100 cubic feet or more per acre, with the largest volume in the 10-inch-plus d.b.h. class.

1/ Wood volumes here include the stem volume of trees greater than 3.5 inches d.b.h. (outside bark), measured from a one-foot stump to a four-inch top diameter inside bark.

2/ Forest Districts are shown on Map 3.

TABLE 3-2

Volume by District, Species and Size Class, New Brunswick, 1958

Forest District	Species Class	D.B.H. Class - Inches 4 - 5		6 - 9		10+		Total		10+
		million cubic feet								million f.b.m.
1	Softwood	490	(31)	1,144	(126)	1,438	(220)	3,072	(377)	5,738
	Hardwood	152	(30)	276	(136)	588	(1,026)	1,016	(1,192)	-
	Total	642	(61)	1,420	(262)	2,026	(1,246)	4,088	(1,569)	-
2	Softwood	643	(17)	1,345	(45)	913	(51)	2,901	(113)	3,867
	Hardwood	102	(23)	288	(115)	469	(216)	859	(354)	-
	Total	745	(40)	1,633	(160)	1,382	(267)	3,760	(467)	-
3	Softwood	467	-	1,071	-	473	-	2,011	-	1,814
	Hardwood	187	-	341	-	299	-	827	-	-
	Total	654	-	1,412	-	772	-	2,838	-	-
4	Softwood	343	-	983	-	596	-	1,922	-	2,334
	Hardwood	142	-	425	-	527	-	1,094	-	-
	Total	485	-	1,408	-	1,123	-	3,016	-	-
5	Softwood	282	(11)	880	(46)	879	(88)	2,041	(145)	3,396
	Hardwood	103	(18)	253	(99)	769	(584)	1,125	(701)	-
	Total	385	(29)	1,133	(145)	1,648	(672)	3,166	(846)	-
All	Softwood	2,225	-	5,423	-	4,299	-	11,947	-	17,149
	Hardwood	686	-	1,583	-	2,652	-	4,921	-	-
	Total	2,911	-	7,006	-	6,951	-	16,868	-	-

NOTE: Additional volume of standing dead trees shown in brackets (not available for Forest Districts 3 and 4).

Source: New Brunswick forest inventory, 1958.

Group II - volume estimated to be 600 cubic feet or more per acre, with the largest volume in the 6- to 9-inch d.b.h. class.

Group III - volume estimated to be 1,000 cubic feet or less per acre, with the largest volume in the 10-inch-plus d.b.h. class.

Group IV - volume 1,000 cubic feet or less per acre, largest volume in the 4- and 5-inch d.b.h. class or with no merchantable volume.

Table 3-3 indicates the distribution of volume and area by maturity group. Group II, comprising the predominantly pole-sized forest stands, occupies nearly half the forest area and contains more than half the volume. Groups II and IV, the young forest, consist predominantly of softwood species. The greater proportion of hardwoods in Groups I and III results, at least in part, from the removal of the larger softwoods for sawlogs and pulpwood.

Growth, Loss and Stability

Table 3-4 summarizes the estimated volume changes for the province by forest district and species group. The average drain by cut-

ting, as estimated from a survey of primary production, 1/ is as follows:

District	Cubic Feet Per Acre Per Year
1	11.6
2	9.6
3	10.0
4	11.4
5	13.9

Net growth of softwoods alone is therefore apparently more than double the cutting drain in Districts 2, 3 and 4 and nearly double in the other two districts.

The growth figures of Table 3-5 are based on remeasurement of a series of some 200 permanent sample plots in each district. Individual trees on each plot were numbered so that volume increment, ingrowth and mortality were determined tree by tree and plot by plot. Additional sample plots were used for the general inventory. (See Table 3-3.) Table 3-5 provides a comparison of the average per-acre volume of stocked forest land, calculated from the general inventory, with the "Original Volume", that is, the average per-acre volume of the growth plots alone, as given in Table 3-4.

TABLE 3-3

Volume and Area by Maturity Group, New Brunswick, 1958

Maturity Group	Softwood	Hardwood	Stocked Forest	Average Volume Per Acre
	million cu. ft.		thousand acres	cu. ft.
I	1,650	1,101	1,542	1,770
II	7,222	2,336	6,532	1,460
III	1,260	958	1,942	1,130
IV	1,815	526	3,794	620
Total	11,947	4,921	13,810	-

Source: New Brunswick forest inventory, 1958.

1/ New Brunswick forest inventory, Supplements, 1963, 1964 and 1966.

TABLE 3-4

Estimated Volume Changes, New Brunswick Forest Districts

Forest District	Item	Softwood		Hardwood		All Species	
		----------- cu. ft. per acre ----------					
1	Original Volume	1,029.7		314.5		1,344.2	
	Annual:						
	Net growth	20.0	(1.9)	10.1	(3.2)	30.1	(2.2)
	Mortality	18.1	(1.8)	4.3	(1.4)	22.4	(1.7)
	Gross growth	38.1	(3.7)	14.4	(4.6)	52.5	(3.9)
2	Original Volume	1,091.8		342.8		1,434.6	
	Annual:						
	Net growth	23.4	(2.1)	7.2	(2.1)	30.6	(2.1)
	Mortality	16.6	(1.5)	6.1	(1.8)	22.7	(1.6)
	Gross growth	40.0	(3.6)	13.3	(3.9)	53.5	(3.7)
3	Original Volume	880.2		271.5		1,151.7	
	Annual:						
	Net growth	29.9	(3.4)	6.5	(2.4)	36.4	(3.1)
	Mortality	7.9	(0.9)	4.2	(1.5)	12.1	(1.1)
	Gross growth	37.8	(4.3)	10.7	(3.9)	48.5	(4.2)
4	Original Volume	1,013.3		541.0		1,554.3	
	Annual:						
	Net growth	28.9	(2.9)	10.6	(2.0)	39.5	(2.5)
	Mortality	11.3	(1.1)	9.1	(1.7)	20.4	(1.3)
	Gross growth	40.2	(4.0)	19.7	(3.6)	59.9	(3.9)
5	Original Volume	1,096.6		541.7		1,638.3	
	Annual:						
	Net growth	25.9	(2.3)	19.3	(3.5)	45.2	(2.8)
	Mortality	15.1	(1.4)	4.7	(0.9)	19.8	(1.2)
	Gross growth	41.0	(3.7)	24.0	(4.4)	65.0	(4.0)

NOTE: Figures in brackets are growth and mortality expressed as a percentage of original volume.

Source: New Brunswick forest inventory, 1958, and Supplements, 1963, 1964, 1966.

TABLE 3-5

Average Volumes on Growth and Inventory Plots and Annual Growth Rates, New Brunswick Forest Districts

Forest District	Original Volume on Growth Plots	Inventory Volume Stocked Forest	Annual Gross Growth	
	------------ cu. ft. per acre	---------------		%
1	1,344	1,420	52.5	3.90
2	1,435	1,410	53.5	3.70
3	1,152	970	48.5	4.20
4	1,554	945	59.9	3.85
5	1,638	1,530	65.0	3.95

Source: New Brunswick forest inventory, 1958, and Supplements 1963, 1964, 1966.

In Forest Districts 1, 2 and 5, average volumes on the growth plots are of the same order of magnitude as the inventory averages. In Districts 3 and 4 these average volumes differ appreciably. However, the annual gross growth rates are remarkably constant and average almost four per cent. It is apparent that gross growth varies from 48 to 65 cubic feet per acre per year and averages about 56 cubic feet for the province.

Volumes of standing dead trees are indicated in brackets in Table 3-2 for the three districts in which these data were collected. These figures indicate a substantial wood volume in this category; more than one-quarter of the standing timber volume in District 1, for example. Yellow and white birch are reported (New Brunswick, 1958) to account for about 72 per cent of the volume in standing dead trees. This undoubtedly is attributable to an attack of birch die-back which immediately preceded the inventory. Examination of Table 3-4 reveals that this excessively large mortality amounted at that time to approximately one-third of the gross growth. In the long run, however, more intensive forest management may be expected to reduce this loss and increase the proportion of harvestable material appreciably.

The distribution, by ownership, of productive forest land not satisfactorily stocked with commercial tree species is presented in Table 3-6. The greatest concentration of this land is in small private holdings (Seheult, 1964). Some of this land is marginal agricultural land, adjacent to arable land. It tends to occupy the better sites for forestry and is relatively accessible.

The rehabilitation of these lands, particularly the small holdings and New Brunswick Crown lands, constitutes a major forest-management problem. Prevention of any increase in this area of unstocked forest land is critical to the maintenance and increase of provincial forest

TABLE 3-6

Unstocked Forest Land by Ownership and Type, New Brunswick, 1958

Land Class	Freehold		Crown		Total
	Small 1/	Large 2/	N.B.	Federal 3/	
	thousand acres				
Cut	273	68	194	13	548
Burn	152	67	395	26	640
Old Field	300	4	-	9	313
Total Unstocked Productive Forest Land	725	139	589	48	1,501
Total Productive Forest Land	4,475	3,564	6,929	320	15,288
	percentage of productive forest land 4/				
Cut	6.1	1.9	2.8	4.1	3.6
Burn	3.4	1.9	5.7	8.2	4.2
Old Field	6.7	0.1	-	2.8	2.0
Total	16.2	3.9	8.5	15.1	9.8

1/ Small Freehold refers to small granted properties in and adjacent to settled areas. They include the woodland on farms and forest properties of small size held by non-farm owners.
2/ Large Freehold refers to granted lands held in large blocks and some adjacent small lots when held by the same owner.
3/ Federal Crown are lands held in the name of the Government of Canada, including military and Indian reserves.
4/ For example, of the total area of productive forest land, 725,000 acres or 16.2 per cent are in small private holdings, 273,000 acres or 6.1 per cent are in small holdings classified as cut (over), etc.

Source: New Brunswick forest inventory, 1958.

production over the long run. To the extent that the "unstocked" land satisfactorily regenerates naturally, the seriousness of the problem is, of course, lessened.

However, the adequacy of natural regeneration of cut-over and burned forest lands is not necessarily correctly represented by the data available. The currently accepted minimum standard for satisfactorily stocked forest land, as interpreted from aerial photographs, requires a stand of trees over 10 feet in height occupying more than five per cent of the ground area. Thus, some of the land classed as stocked may support very sparse and scrubby forest which is likely to take many extra years to

produce a commercial forest if, indeed, such regeneration is possible without planting. Conversely, some land may be stocked with small trees.

Clearly, more explicit definitions are needed. The forest inventory definition of stocked productive forest land (and thereby, of unstocked forest land) could well be supplemented by adding a definition, based on field examination, suitable for forest managerial decision-making. Needed are descriptive measures of "full", "adequate" and "inadequate" stocking, based on numbers and spacing of commercial tree species, required at various stand ages to provide an acceptable growing stock per acre at rotation age on various forest sites. Only with such definitions can understocked areas be identified and timber stand improvement measures prescribed.

With respect to non-cutting factors, such as disease, insects, fire, weather and succession, New Brunswick forests are in a generally favourable position. Nevertheless, a preponderance of mature and overmature spruce-fir forests in north-central New Brunswick has provided favourable conditions for continued wide-spread attacks of the spruce budworm. Extensive annual applications of insecticides by aerial spraying, jointly sponsored by the pulp and paper companies and the federal and provincial governments, has been necessary to control insect populations and tree mortality. A major research program has been undertaken by the federal government in order to seek ways and means of controlling successfully this serious forest pest without undue injury to other inhabitants of forested areas, such as fish and wildlife.

Fire losses are comparatively light. Of the provinces, only Newfoundland has a lower ratio of area burned to total forest land.

Sustained Annual Yield Potential

New Brunswick stands fourth among the provinces of Canada in timber production and fifth in volume of timber reserves. Considering the size of the province and its population, however, the forest industry is pre-eminent. In fact the forest resource accounts for some two-fifths of the net value of all physical products. Pulp and paper manufacturing is unrivalled as the most important industry of the province.

Non-productive forest land amounts to but two per cent of all forest lands in the province and nearly all productive forest land must be considered accessible.

The potential for sustained yield is generally excellent because of favourable soil and climatic conditions. The production of at least one-half cord per acre per year over substantial areas of forest land appears to be a reasonable objective.

One problem not clearly defined by provincial inventory data is the uneven distribution of age classes. Table 3-7 reveals a scarcity of mature and large-sized timber (Groups I and III) in Districts 3 and 4 and an over-abundance of pole-sized timber (Group II) in District 2.

The relatively high proportion of merchantable size classes (Groups I, II and III), when cut, will eventually result in a disproportionately large area of forest land supporting small merchantable and unmerchantable size classes. 1/ Regulation of a forest so that an appropriate mixture of pulpwood and sawlog-sized trees reach maturity on a regular basis is an objective of sustained-yield forest management. Additional re-adjustments of land and timber holdings, by sale or exchange, may still be required if New Brunswick's forest-based industries are to be assured adequate raw-material supplies in the decades ahead.

Development to full potential of New Brunswick's forest industry depends on the early and general application of scientific forest management. That potential is not likely to be reached until the responsibility for forest and timber management of Crown lands held under licence tenure has been clarified. One owner of extensive freehold forest lands has adopted relatively intensive forest-management practices over the past few years. No less should be expected of holders of forest-management licences.

TABLE 3-7

Productive Forest Land by Condition Class and Forest District, New Brunswick, 1958

Condition Class	Forest District 1	2	3	4	5	Province
	------ per cent of productive forest -------					
Stocked Forest:						
Maturity Group I	14.9	11.4	6.1	3.4	18.5	10.1
Maturity Group II	36.8	50.1	43.3	42.5	40.6	42.6
Maturity Group III	10.2	7.0	11.1	19.4	15.0	12.7
Maturity Group IV	27.2	25.2	25.9	24.3	19.8	24.8
Total Stocked	89.1	93.7	86.4	89.6	93.9	90.2
Unstocked Forest:						
Cut	4.1	2.6	4.1	3.7	3.2	3.6
Burn	6.3	3.0	5.5	3.6	1.5	4.2
Old Field	0.5	0.7	4.0	3.1	1.4	2.0
Total Unstocked	10.9	6.3	13.6	10.4	6.1	9.8
Productive Forest Land	100.0	100.0	100.0	100.0	100.0	100.0

Source: New Brunswick forest inventory, 1958.

1/ If the rate of cutting is low, the extent of the problem is lessened.

2. TENURE AND PRODUCTION

Timbersheds of Pulp and Paper Companies

The seven pulp and paper companies operating in New Brunswick in 1966 owned a total of 2.2 million acres of freehold forest land and leased another 5.7 million acres from the provincial government. Four of the seven companies owned little private land; the remaining three owned 98 per cent of large freehold holdings. Licences ranged in area from less than 100,000 acres to 1.8 million acres, with five companies holding more than 700,000 acres each.

TABLE 3-8

Volume and Cut of Timber on Pulp and Paper Timbersheds, New Brunswick, 1965

	Softwood	Hardwood
	---cunits (100's of cu. ft.) -----	
Standing Timber Volume		
Crown Licence	34,254,000	11,422,000
Freehold	15,605,000	7,920,000
Total	49,859,000	19,342,000
Allowable Cut	1,552,755	606,175
Actual Cut		
Crown Licence	735,000 1/	53,000 2/
Freehold	260,000 1/	- 2/
Total	(995,000)	(53,000)

1/ Estimated from partial returns.
2/ No information.

Source: Company returns, 1966.

Standing timber volume, allowable cut and actual cut statistics for the pulp and paper industry are summarized in Table 3-8.

Of 6.95 million acres of productive Crown forest land in New Brunswick, pulp and paper companies lease 5.7 million acres or 82 per cent. Of a reported annual allowable cut of 2.16 million cunits of softwoods and hardwoods, these same companies in 1965 cut an estimated 1.07 million cunits, about 50 per cent of the allowable cut. For softwoods only, the actual cut was about two-thirds of that allowed by the forest-management plan.

The rate of cutting on Crown lands, as revealed in the 1958 inventory, varied from a high of 20 per cent in District 5 to a low of 0.7 per cent in District 2. These rates correspond to inferred cutting cycles of 50 to 143 years. Viewed from any angle, Crown lands appear to be grossly undercut. Pulp and paper companies, as the main licensees must bear the main responsibility.

Timbersheds of Large Sawmills

Provincial statistics (New Brunswick, 1965 b) show 48 sawmills with an annual capacity of more than 2 million feet board measure (f.b.m.). Of these, seven are operated by four pulp and paper companies as integrated enterprises. Of the remainder, three companies operate two mills each, for which statistics have been combined, one had discontinued sawmilling operations and one had been incorrectly classified as a large mill. Therefore, the timbershed statistics that follow relate to 36 sawmilling companies.

Twelve sawmill operators each own more than 5,000 acres of freehold timberland, two owning some 40,000 acres each. However, a poor correlation exists between sawmill capacity and timberland acreage. Several large producers own little or no timberland. A few are now buying timberland. Several pulp and paper companies and pulpwood exporters are also in the market for land and timber.

A poor correlation also exists between installed sawmill capacity and size of Crown licence. One of the largest operators leases less than 6,500 acres. In all, licensed lands controlled by the sawmill industry amount to about 600,000 acres, freehold lands exceed 150,000 acres (Table 3-9).

TABLE 3-9

Timberland Owned or Controlled by Sawmilling and Pulp and Paper Industries, New Brunswick, 1966

Industry	Freehold		Licensed		Total	
	000 acres	%	000 acres	%	000 acres	%
Sawmilling	150	2	600	7	750	9
Pulp and paper	2,163	25	5,694	66	7,857	91
Total	2,313	27	6,294	73	8,607	100

Source: Company returns, 1966.

In part, the disparity between raw-material supply and productive capacity of sawmills is offset by arrangements entered into with pulp and paper companies. Agreements to purchase stumpage or sawlogs

may also be made with holders of smaller Crown licences or private land-owners.

No more than one-quarter of the owners of independent sawmills appear to control log supplies sufficient to meet even their short-term requirements, i.e., from two to five years. Some mills producing as much as 2 million f.b.m. per year must purchase almost all their logs from farmers and owners of small holdings. The remainder, with few exceptions, are dependent upon agreements with pulp and paper companies, negotiated annually as to quantity and price. The terms of such agreements may require the operator to supply both pulpwood and sawmill chips to the pulp mill in return for the privilege of purchasing sawlogs. In all, between 20 and 25 sawmills, with total annual production in excess of 100 million f.b.m., are dependent upon such agreements with pulp and paper companies. Only three of these contracts exceed a one-year term, two five-year agreements were reported, one for 20 years. Almost three-quarters of the larger sawmills are therefore almost entirely dependent upon the good will of pulp and paper companies for their raw-material supply.

The volume of sawtimber standing on limits owned or controlled by sawmilling companies is very difficult to estimate. Sixty per cent of the independent sawmillers interviewed gave no estimate of their timber reserves, if any. They appear to control a total inventory of about one billion f.b.m., more than half held by seven or eight companies.

The sawlog cut in 1965 approximated 240 million f.b.m., of which between 15 and 20 per cent was hardwood.

Sawtimber growth estimates were limited largely to the measurements or observations of a few individuals. Two independent measurement-based estimates, for softwoods in the Miramichi watershed, averaged 22 cubic feet or 110 board feet per acre per year. Other estimates were based on compound interest growth rates of from 3 to 5 per cent. The best estimates of growth are undoubtedly those of the provincial Department of Natural Resources. (See Table 3-4, page 3-5.)

The seven sawmills operated by pulp and paper companies have annual capacities of up to 25 million f.b.m. and a combined annual production of some 100 million f.b.m., about 10 per cent hardwood.

Several operators of small sawmills hold Crown licences on small, scattered blocks. One larger licence in Forest District 3 is held by a sawmill company cutting between 1.5 and 2.0 million f.b.m. annually.

Additional forest lands are held under Crown licence by several pulpwood exporters and jobbers, comprising about 75,000 acres in Forest District 3 and 35,000 acres in District 4. Annual cut or growth estimates for these areas are unavailable. The export of pulpwood from Crown lands is very small.

With respect to private holdings, one exporter alone owns more than 270,000 acres of freehold land in District 4 with timber volumes of more than 150 million cubic feet of softwood and 100 million cubic feet of hardwood. The annual cut on this land is 3.8 million cubic feet of soft-

woods; the growth is estimated to be 6.4 million cubic feet of softwood and 3.0 million cubic feet of hardwoods.

Effect of Scale and Tenure on Forest-Management Practices

Crown Licence. Current regulations require all licensees to prepare a forest-management plan. Following amendments to the Crown Lands Act in 1961-62, the Department of Lands and Mines (and its successor) offered a reduction in royalties to licensees undertaking total utilization of both sawlogs and pulpwood. The report of the Scaling and Forest Management Branch (1965) noted that "This incentive of reduced royalty has not in this one year had the desired effect of increasing substantially the output of sawlogs."

Scale of Operations. As noted elsewhere in this report, land classed as large freehold has, on the average, a far higher level of stocking than small holdings. Table 3-10 shows that large freehold properties, relative to small holdings, have nearly six times the proportion of mature forest (Maturity Group I) and half the proportion of saplings and reproduction (Group IV). Further, unstocked land due to cutting is only one-third as prevalent on large holdings as on small. The better condition of large holdings is clearly due to less cutting or improved cutting practices. Additional inventory results show nearly twice as much timber volume per acre on large holdings compared with small, and more than three times the sawtimber volume.

Some small holdings are well managed and produce more than one cord per acre per year on a selection system of sylviculture. But, despite the efforts of a well-staffed forestry extension service, the average level of stocking and intensity of management on small holdings are undesirably low.

The larger freehold properties, with their higher levels of stocking, provide more favourable conditions for forest management. Indeed, the owner of the largest area of freehold properties in the province has his own forest nursery and has initiated a program of reforestation and stand improvement equal to the best of private enterprise in eastern Canada.

Yet, for many large holdings, both Crown licence and freehold, the rate of cutting may have been over-conservative and the intensity of forest management less than adequate in the past. Adequate forest management implies application of management plans to the major part of the commercial forest, including freehold properties as well as licensed and unlicensed Crown lands. Plans can only be effective if continually updated, and some recent progress in this sphere has been reported by provincial authorities. It is of paramount importance, however, that provincial authority in management planning include regulation of the location of cut as well as volume.

TABLE 3-10

Forest Condition Classes on Small Holdings and Large Freehold Properties

Condition Class	Area	
	Small Holdings	Large Freehold
	%	%
Stocked Forest:		
Maturity Group I	2.7	15.5
Maturity Group II	35.6	47.6
Maturity Group III	12.1	16.5
Maturity Group IV	33.4	16.5
Total Stocked	83.8	96.1
Unstocked Forest:		
Cut	6.1	1.9
Burn	3.4	1.9
Old Field	6.7	0.1
Total Unstocked	16.2	3.9
Productive Forest Land:		
Per Cent	100.0	100.0
Area (000 acres)	4,475	3,564

Source: Derived from Table 4, New Brunswick forest inventory, 1958.

3. PULP AND PAPER

Nine pulp and paper mills are operated by seven companies in New Brunswick at the following locations: Atholville, Bathurst, Dalhousie, Edmunston, Newcastle, St. George, Saint John (2) and South Nelson. (See Map 5.)

Products range from groundwood, sulphite and kraft pulp, bleached and unbleached, to paper, newsprint and board. Five of the mills produce only pulp. One small mill has a capacity of 75 tons per day (T.P.D.), six mills produce between 400 and 600 T.P.D., one mill, to be enlarged, is rated under 300 T.P.D., while the largest mill has a capacity of 900 T.P.D. (See Table 3-11.)

The fibre inputs were estimated to be 1,525 thousand cords of pulpwood and 262 thousand cords of chips from sawmills in 1965. For 1966, these estimates were 1,756 thousand cords and 236 thousand cords. 1/

The total pulp and paper labour force, exclusive of office and salaried staff, is approximately 3,800 on a yearly basis. The D.B.S. estimate is 4,000 plant workers (4,600 including salaried staff). Most of the mills are unionized, and the work week ranges from 40-42 hours (union) to 48 hours (non-union). Union hourly rates in pulp mills range from about $2.13 minimum for a labourer to $3.35 for skilled trades and machine-tenders. The hourly average is estimated to be about $2.75. Paper-makers receive somewhat more, with "boss machine tenders" getting as high as $4.77 per hour (union). Non-union rates range between $1.45 and $1.81 for pulp mill workers.

Little or no seasonality is associated with pulp and paper manufacturing.

Because of the varying ages and sizes of the mills, labour productivity is extremely variable, ranging from 16 man-hours per ton for groundwood pulp to just under 6 man-hours per ton for a combination of bleached and unbleached sulphite pulp. Wood utilization is also variable, ranging from about 1.1 cords per ton of air-dried groundwood pulp to 1.85 cords per ton of sulphite pulp.

1/ Pulpwood and Residue Statistics, v. 9, no. 12. D.B.S.

TABLE 3-11

New Brunswick Pulp and Paper Industry, 1965 1/

Product	Capacity Day	Capacity Year 2/	Plant Labour	Capital Value 3/	Limit Wood	Purchase Wood Chips	Purchase Wood Roundwood	Total Wood	Output Volume	Output Value 5/
	tons	000 tons	no.	$000,000	000 cords 4/				000 tons	$000,000
Paper:										
Newsprint	1,300	470	1,150	43	370	-	160	530	415	56.4
Board	640	224	880	35	150	18	60	228	201	31.5
Other	40	14	100	7	-	-	28	28	14	3.2
Pulp:										
Groundwood	565	210 6/	300	18	183	-	25	208	160	9.6
Sulphite	925	324	950)	100	(307	85	250	642	275	33.0
Kraft 7/	750	262	460)		(260	40	170	470	155	19.8
Total	4,220	1,504	3,840	203	1,270	143	693	2,106	1,220	153.5
D.B.S. estimate 8/	-	-	4,008	-	-	-	-	1,788	-	141.1

1/ Company returns, 1966.
2/ Where not specifically stated, 350 working days used.
3/ Not on uniform basis. Replacement value estimated at $400 million.
4/ Fibre requirements estimated for conditions of normal capacity. Limit wood may include chips.
5/ Production valued at market prices, even when for internal use. This explains partly the discrepancy with D.B.S. estimate.
6/ June 1967, St. George Pulp and Paper Company, annual capacity 24,000 tons, announced permanent closure of mill.
7/ Included is production capacity installed in Newcastle in 1966. Full production expected by mid-1967.
8/ Paper and Pulp Mills, 1965. D.B.S.; Pulpwood and Wood Residue Statistics, v. 9, no. 12. D.B.S.

4. SAWMILLING

There were approximately 279 sawmills operating in New Brunswick in 1965 (New Brunswick, 1965 b). 1/ Most are small (Table 3-12).

TABLE 3-12

Sawmills Classified by Production, New Brunswick, 1965

Production Class	Sawmills	
million f.b.m.	no.	%
Over 6.0	19	6.8
2.0 - 6.0	27	9.7
0.5 - 2.0	49	17.5
Under 0.5	184	66.0
Total	279	100.0

Source: Sawmills operating in New Brunswick, 1965. New Brunswick Department of Lands and Mines, Fredericton.

Characteristically, the smaller mills are portable or home-made, relatively low in efficiency. They are operated intermittently and provide some poorly manufactured lumber for local consumption. While they provide sporadic employment for a few low-paid employees, it would be hard to justify steps to keep these small mills in operation. Nor do they add significantly to the sawmill output. Two-thirds of the sawmills (producing under 500,000 f.b.m. annually) saw only six per cent of the lumber (Table 3-13).

The 46 sawmills cutting over 2 million f.b.m. annually are operated by 40 companies and produce over 300 million f.b.m. or about 80 per cent of the annual production of lumber (Table 3-13). They are typically permanent set-ups with a single 48-inch circular head-rig. Some have twin circular headsaws, some include round-log or cant-gang installations, and three have vertical band-saw head-rigs. Specialty mills include two or three "stud" mills and one spoolwood mill.

1/ D.B.S., however, reported returns from only 134 sawmills and planing mills in 1965. Many small producers report irregularly, if at all, a fact which clouds the reliability of industry statistics.

TABLE 3-13

Annual Sawmill Output by Production Class, New Brunswick, 1965

Production Class	Sawmills		Estimated Total Annual Production	
million f.b.m.	no.	%	million f.b.m.	%
Under 0.5	184	66	23 1/	6
0.5 - 1.0	23	8	17 1/	4
1.0 - 2.0	26	9	37 1/	10
Over 2.0	46	17	300 - 325 2/	80
Total	279	100	377 - 402 3/	100

1/ Estimated from production-class mid-points multiplied by number of mills.

2/ Based on personal interviews with all but three operators.

3/ Subsequently reported D.B.S. statistics for 1965 show a total lumber production of 291 million f.b.m. based on returns from 134 sawmills. An independent survey conducted by N.L. Kissick in 1962, in which all operating sawmills were visited, showed an estimated cut in 1961 of 363 million f.b.m.

Like other forest-based industries, sawmilling tends to be resource-oriented but, because of the wide distribution of the forest and relatively small production units, New Brunswick's sawmills are widely distributed. (See Map 6.) However, the larger mills tend to be concentrated at the outlets of the main watersheds. The mouth of the Miramichi River, for example, has attracted a concentration of sawmilling over the past century attributable to the availability of suitable sawtimber and the export of lumber products through the port of Newcastle.

Much of the lumber produced is spruce, most commonly in sizes for framing and joists. For the domestic and American markets this lumber is usually dressed. Most larger sawmills operate their own planing mills and buy additional rough lumber from smaller sawmills for dressing prior to resale. Lumber sold on the United Kingdom market is usually shipped rough because of the tariff imposed on dressed lumber.

Specialty products include softwood studs (2" x 4" x 8') and various hardwood items, such as railway ties, mine packs, spoolwood and barrel staves. Other softwood products include laths, box shooks and crating stock.

By-products include increasing quantities of pulpwood chips, while the sale of slabs and edgings for fuelwood is declining.

Unit capital investment in sawmills producing over 2 million f.b.m. annually is extremely variable, ranging from about $15,000 to over $1.5 million. A relatively modern installation which included a debarker and chipper was valued at $150,000, but other mills in the same class carried higher valuations, particularly those which included a planing mill.

Most of the sawmills producing over 6 million f.b.m. annually were relatively well-equipped and efficiently operated. Only a few in the 2-6 million f.b.m. class appeared to be viable units.

All larger sawmills, but only half of those cutting between 2 and 6 million f.b.m., have installed debarkers and chippers (Table 3-14).

TABLE 3-14

New Brunswick Sawmills with Debarkers and Chippers, 1965

Production Class	Sawmills	Mills with Debarkers and Chippers	
million f.b.m.	no.	no.	%
Over 6.0	19	19	100
3 - 6	14	8	57
2 - 3	11	5	46
Total	44	32	73

Source: Company returns, 1966.

Only a few of the larger independent sawmills have an adequate and assured supply of suitable sawlogs. Without reasonable assurance of continuity of production, sawmill operators experience difficulty in obtaining risk capital for modernization and expansion.

Inputs

Excluding sawmills operated by pulp and paper companies, operators of larger sawmills obtain their sawlogs as follows:

from own limits	25%
from pulp and paper co. limits	55%
from purchase of logs/stumpage	20%

Hardwoods comprise approximately 15 per cent of the total sawlog input, about 20 per cent of the sawlogs cut on sawmills' own limits. Most hardwood sawlogs cut by sawmills appear to be purchased.

Labour productivity varies from mill to mill. However, lumber production per man-year seems to range from about 130,000 f.b.m. in small sawmills up to about 350,000 f.b.m. in some of the large automated mills. On the average, the larger mills produce about 220,000 f.b.m. of lumber per man-year.

Counting only those men on the mill floor, average productivity varies from 1,000 to 5,000 f.b.m. per man-day. Larger mills produce an average of about 3,000 f.b.m. per man-day; smaller mills about 2,000 f.b.m.

Pay rates in the sawmill industry are much lower than in the pulp and paper industry. In the few unionized mills, hourly rates for a 44-hour week ranged from $1.42 to $2.52 in 1966. Most sawmill workers are not unionized and work a 50-hour $5\frac{1}{2}$-day week at hourly rates from $1.05 (the minimum wage) to $2.00. Only a few sawmills use incentive bonuses or piecework rates. One operator reported that introduction of a bonus system resulted in a 40-per-cent increase in production, a 20-per-cent reduction in costs, and a 30-per-cent increase in weekly wages per employee, despite a shorter work week.

After sawlogs and labour, power is the principal additional input, accounting for some 90 per cent of additional costs. Only two mills visited use diesel power, at an operating cost of about 50 cents per thousand f.b.m. One hardwood mill generates its own steam power by burning slabs and edgings at a labour cost of $2.30 per thousand. As sawmill residues increase in value as a source of pulpwood chips and as labour rates rise it becomes uneconomical to continue using sawmill "waste" as a source of power.

Virtually all larger sawmills use electric power. According to officials of the New Brunswick Electric Power Commission, electricity costs 70 cents per thousand f.b.m. in mills cutting 10 million f.b.m. annually, 60 cents per thousand in mills cutting 20 million. Power costs for chipping are estimated to be 30 cents per bone-dry ton. A sawmill producing 10 to 20 million f.b.m. per year operating for a nine-hour day on a Class I industrial power rate pays 2.4 cents per k.w.h. If operating two nine-hour shifts per day, the power cost drops to 1.6 cents per k.w.h.

One sawmiller estimated his power cost to be 90 cents per thousand when operating a single shift; another estimated that the additional cost for power in operating a second shift was 30 per cent. There is no doubt that considerable cost savings are attainable by operating a sawmill double-shift; unfortunately, New Brunswick sawmills are lucky if they have a sufficient log supply to operate one shift throughout the year, let alone two.

Output

New Brunswick's annual production of lumber is estimated to be about 375 million f.b.m. Sawmills producing over 2 million f.b.m. per year receive mill-run prices ranging from $65 to $85 per thousand for rough, green softwood lumber. Hardwood lumber is sold for up to $110 per

thousand; culls for about $40. The provincial average is currently about $70 per thousand f.b.m.

A total of about 215,000 units (bone-dry tons) of chips are produced annually from sawmill residues. Recovery rates range from 0.75 to 1.0 unit per thousand f.b.m., averaging 0.8. Studmills, which use small logs, produce a larger proportion of chips, up to 1.4 units per thousand f.b.m.

By tree-length logging, one operator reported a recovery of 1.25 units per thousand f.b.m., an increase of 50 per cent in chip recovery by using the tree tops. The estimated additional revenue to the operator from sale of pulpwood chips amounted to $5 per thousand f.b.m. of sawlog volume.

Prices paid for pulpwood chips in 1966 ranged from $19 to $21 per unit delivered at the pulp mill.

Annual volume and value of New Brunswick's sawmill outputs are summarized in Table 3-15. Lumber, comprising about 80 per cent of the utilized portion of sawlogs, contributes about 86 per cent of the sales value. Chips make up the balance.

TABLE 3-15

Annual Volume and Value of Sawmill Outputs, New Brunswick

Product	Volume				Value 1/	
	000,000 f.b.m.	000 units	000,000 cu. ft. 2/	%	$ 000	%
Lumber	375	-	75.0	80.4	26,250	86.0
Chips	-	215 3/	18.3	19.6	4,300	14.0
Total	-	-	93.3	100.0	30,550 4/	100.0

1/ Using these Unit Values: lumber, $70/M; chips, $20/unit.
2/ Roundwood equivalent, assuming conversion factors: 1,000 f.b.m. = 200 cu. ft; 1 unit = 85 cu. ft.
3/ Derived from Tables 3-13 and 3-14.
4/ D.B.S. estimate (1965): $34.5 million for sawmills and planing mills.

The development of a market for pulpwood chips manufactured from sawmill residue has resulted in a 25-per-cent increase in fibre recovery and a corresponding increase of 16 per cent in value recovery from sawlogs. Adoption of the practice of tree-length logging could further increase the value obtainable for a tree or stand.

Marketing and Transportation

Approximately half the total output of all sawmills producing over 2 million f.b.m. annually is marketed in the United Kingdom and Europe, one-quarter in the United States, one-quarter in Canada. Only rough lumber is shipped to the United Kingdom because of a duty on dressed lumber. Lumber sawn a full two inches thick is sold on this market as 1 3/4-inch lumber. A recent demand for packaging requires the steel-strapping of bundles sorted not only by grade, thickness, and width, but also by length. The larger mills are consequently installing automatic length sorters.

The demand for lumber on the United States and domestic markets is primarily for dressed or planed lumber. Operators of larger sawmills have installed planing mills in which they dress their own stock as well as lumber bought from smaller sawmills.

Most lumber destined for export is graded, but not exclusively by Maritime Lumber Bureau grades. Private grades are still used by some of the larger and older companies. Lumber sold to wholesalers, including most of the production of many of the smaller companies, is sold ungraded.

Marketing remains the responsibility of the individual producer. About 1960 an attempt to form a Maritime lumber-exporting agency failed because many exporters failed to give enthusiastic support and one major producer actively opposed the plan. An important factor contributing to this short-term market view may be the short-term sawlog supply.

Most lumber is moved, at least in part, from mill to market by truck, whether hauled direct to the New England market or to the nearest seaport for trans-shipment overseas. Weight restrictions on public highways during spring break-up, though necessary, are cited as an added cost factor. Rail is favoured for domestic shipments, especially to Québec and Ontario.

Packaged lumber facilitates loading and unloading both ships and railroad cars; labour unions, especially representing longshoremen, tend to retard the mechanization of lumber-handling.

Some New Brunswick ports used for lumber exports are not ice-free during the winter and accommodate only shallow-draft tramp freighters.

5. PLYWOOD AND OTHER FOREST PRODUCTS

The only softwood-plywood plant in the Atlantic Region was built in 1962 at Chatham, at the mouth of the Miramichi River. Log inputs were 5.5 million f.b.m. of spruce and pine annually, mostly spruce.

Labour employed included four supervisors and 70 hourly employees working a 44-hour week at hourly pay rates ranging from $1.37 to $2.37 and averaging $1.60.

The output included the equivalent of 13 million square feet of 5/16-inch plywood produced in a ten-month operating season. Total sales value of product, including cores and chips, exceeded $1.0 million annually. Sixty per cent of the plywood produced was sold on the United Kingdom market, the balance locally.

In November 1966, this plant was totally destroyed by fire. Plans are now being made to rebuild it.

Other plants include two producing particle board and at least one each manufacturing shingles, boxboards, wooden culverts and excelsior.

Shingle Mill. The one shingle mill visited, which is believed to be the largest in eastern Canada, uses 1.5 million f.b.m. of old-growth eastern white cedar logs annually, obtained by stumpage agreement with a pulp and paper company. The mill, valued at $20,000, has four shingle machines, a debarker and a waste burner. Employees, including 10 in the woods and 15 in the mill, work a 50-hour week at hourly rates ranging from $1.22 to $1.77.

The electrically-powered mill produces 17,000 squares of shingles annually valued at about $155,000. About two-thirds of the output is marketed in New England, the remainder in Canada.

Log supplies, though plentiful, are scattered and remote. Old-growth cedar is essential for the manufacture of high-grade shingles. An automated shook mill, if added, would make good use of the lower-grade cedar logs.

Particle-board Mills. The two particle-board mills produce 15 to 16 million square feet of 5/8-inch-equivalent particle board in a variety of thicknesses and dimensions.

Both mills employ a relatively non-specific wood input. One uses 90 per cent planer shavings, 10 per cent slab wood; the other uses any species other than cedar, including bark. Total wood consumption is 60,000 cubic yards of shavings and 22,000 cords of wood annually.

The two mills employ a total of 85 men at hourly wages ranging from $1.10 to $2.00. One mill operates three shifts a day, the other only one.

The annual sales value of the product of the two mills is of the order of $2.0 million, with Québec and Ontario the leading markets. The products are used in the manufacture of doors, furniture and wall-board.

Both mills produce a relatively bulky product from non-specific wood inputs for a distant market. Such manufacturing plants should be market-oriented; the raw material is available much closer to the centres of ultimate use.

6. INSTITUTIONAL FACTORS

In recent years sweeping changes have occurred in New Brunswick's tax structure; some are still being implemented. Authority to tax real property has been removed from municipalities and placed solely in the hands of the province. This is the result of enactment in 1965 of part of the recommendations of the Royal Commission on Finance and Municipal Taxation (New Brunswick, 1963 b), commonly known as the Byrne Commission.

Thus far, little is known about the effect of the new taxation policy. Among the recommendations of the Byrne report not yet accepted are those concerning taxation of forest land. It is understood, however, that a more equitable taxation of forest properties, based on productive capacity, will come into effect as soon as necessary preparations, i.e., property maps, sufficiently accurate productivity maps and personnel training,are completed. Implementation is not expected for several years.

Provincial Taxation, Stumpage and Royalties

Freehold Timberland. Under the new Assessment Act, taxation of all freehold forests has become exclusively a provincial field. Section 18 of the Assessment Act reads:

> "For freehold timberland, the assessment shall be calculated by assigning to such timberland a value that will realize a tax of twenty-five cents per acre per year."

The 1963-64 season stumpage rates for pulpwood ranged from \$1.50 to \$8.00 per cord. The prevailing value was \$5.00 per cord (Seheult, 1964). It is believed that no changes in stumpage values have occurred since then.

Crown Land. There are at present five pulp and paper licences, covering an area of 5,400 square miles of Crown land, and 154 forest-management licences, covering an area of 5,062 square miles. Annual renewal fees for both types of licences have to be paid at a rate of 1.6 cents per 100 cubic feet of merchantable softwood, according to the inventory records of the Department of Lands and Mines. An annual forest protection fee is to be paid at a rate of five cents per acre of productive forest land. Royalties range between \$5.25 and \$6.00 per thousand f.b.m. of softwood sawlogs, between \$4.00 and \$10.00 per thousand f.b.m. of hardwood sawlogs and veneer logs, and between \$2.00 and \$3.50 per cord for pulpwood species. The complete royalty rates are published yearly in the annual reports of the Department of Lands and Mines (now Department of Natural Resources).

The 1958 forest inventory shows that private forest holdings comprise 4.6 million acres of small holdings and 3.6 million acres of large holdings. At the present tax rate of 25 cents per acre, provincial revenue is estimated to be \$2.0 million annually.

7. CONCLUSIONS

In the management of a forest resource, first it is necessary to protect the land and timber from its natural enemies: fire, insects and disease. Second, stock must be taken of the land area's potential capability to produce various tree crops, of the existing timber-growing stock and its utility to satisfy the needs of man. Finally, it is essential to develop a plan by which to manage the resource, and to adopt a long-range policy that will assure to succeeding generations a continuing and increasing source of all desired products of that forest land.

Despite well over a century of use and abuse, New Brunswick's forest resources are not yet managed effectively. Provincial efforts to spare the forest from destruction by wildfire have been well rewarded in recent years, but tree mortality resulting from recurring attacks by the spruce budworm remains serious despite annual wide-spread aerial application of insecticides.

The first comprehensive inventory of New Brunswick's forest resources, completed in 1958, is now being revised and supplemented with the federally subsidized Canada Land Inventory involving the assessment of land capability for agriculture, forestry, wildlife and recreation.

Lacking, in New Brunswick, is a clear-cut policy statement assigning responsibility for forest management on large licences, either to the forest-based industries occupying the land, on the one hand, or to the government, the owner, on the other. Any serious consideration of forest management on Crown lands in New Brunswick, leased or not, awaits this policy decision.

Long-range planning is a matter urgently awaiting that decision. Planning, based initially on available forest statistics and knowledge, takes the form of a forest-management plan. As more up-to-date and detailed information becomes available, necessary revisions are made in the management plan.

Meanwhile, guidelines for next year's logging operations and development work are embodied in an annual operating plan, on the basis of which, if approved, cutting permits are issued on Crown limits. Herein are found the guides to next year's cutting operations, the general location of the year's timber supply, the roads and other improvements required to open up the area to be logged. Reference is here made to special problems expected to arise and, most important, provisions made for assuring natural regeneration, such as brush removal, scarification or planting where necessary, to ensure prompt and adequate restocking with desirable tree species well-adapted to the site.

Co-operation of industry and government representatives, particularly provincial, is essential if New Brunswick's forests and forest industries are to be permitted to develop in relation to their economic capabilities under existing forest laws and regulations. In the absence of this true spirit of co-operation, however, the provincial government, as custodian of the Crown lands, is obliged to fulfill its obligation to the people of the province by taking steps to ensure that all such lands are managed for the common good.

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FORESTRY
in the
ATLANTIC PROVINCES

PART FOUR

NEWFOUNDLAND AND LABRADOR

PART FOUR
TABLES

PART FOUR
TABLES

PART FOUR
TABLES

FORESTRY IN THE ATLANTIC PROVINCES

PART FOUR: NEWFOUNDLAND AND LABRADOR

1. NATURE AND DISTRIBUTION OF RESOURCE BASE

Slightly over half the land area of the Island of Newfoundland is forested. Of the other half, open bogs, heath land and rock barrens account for all but a minor fraction. Moreover, most of the forested portion is interspersed with non-forest land. Only a very small percentage of the land area is in use for farming, or for residential and industrial purposes. The total occupied agricultural area is estimated at 54 square miles. Such a preponderance of forests emphasizes the importance of this resource to the economic life of the province.

Unfortunately, much of the forest area is non-productive; that is to say, although the land is treed these trees cannot develop to produce forests of commercial value. These non-productive forests are of four main classes:

1) Tree growth on rock where soil is lacking or is too thin to support tree growth.

2) Tree growth on wet lands. (Most of these lands form a transition zone between commercial forest land and open bog.)

3) Tree growth in a tension zone bordering heath lands.

4) Tree growth on wind-swept areas where, despite favourable soil conditions, the height growth of trees is inhibited.

The soils are very stony and, for this and other reasons, not well-suited to extensive agricultural development. Moreover, areas of arable land are seldom extensive. Swamps, rock outcrops, and shallow soils break up the potential farming land into relatively small patches. These small areas are excellent, however, for growing potatoes, turnips, and cabbages, and many of them, close to settlements, are utilized for this purpose. The total area under cultivation or pasture is small and, although locally important, contributes little to the provincial economy.

The forests vary in composition from place to place, reflecting differences in the local climate, in soil, or in their historical development.

Only two tree species are of outstanding economic importance: balsam fir and black spruce. Others of lesser importance are white spruce, white birch, white pine, yellow birch and larch. Other species of little or no economic value are aspen, red pine and red maple. Both black spruce and balsam fir are found in pure stands, but a mixture of the two is most common, often with birch as a minor component.

Black spruce comprises the bulk of the commercial wood volume in the central part of the Island, while balsam fir is the predominant species on the west coast, including the northern peninsula.

Land Capability Classes

Until the results of the Canada Land Inventory are available about 1970, land capability classes must represent broad groupings of sites. Table 4-1 shows three estimates of the areas occupied by the various classes of land on the Island in square miles. These estimates differ considerably with respect to the area of non-productive forest and the ratio of forested to non-forested land. It is believed that the figures compiled by the Newfoundland Department of Mines and Resources (Column II) represent the best estimate to date. In Table 4-2 the D.B.S. estimate for Newfoundland and Labrador is presented in somewhat more detail, with areas expressed in thousands of acres.

TABLE 4-1

Area Classification, Newfoundland (Island)

Classification	Estimates of Area		
	I	II	III
	-------- square miles --------		
Merchantable forest	7,161	8,147	7,088
Young growth	4,059	4,611	5,560
Total productive forest	11,220	12,758	12,648
Non-productive forest	13,699	6,016	9,809
Total forested area	24,919	18,774	22,457
Non-forested	12,094	18,240	18,370
Total land area	37,013	37,014	40,827
Total water area	5,721	5,720	2,195
Total area	42,734	42,734	43,022

I: From Report to the Sixth British Empire Forestry Conference, Canada, 1952. Prepared by Forestry Branch, Department of Northern Affairs and National Resources.

II: Compiled by Department of Mines and Resources, Newfoundland, 1957; cited by Tunstell (1957).

III: Canadian Forestry Statistics, 1962. D.B.S.

TABLE 4-2

Area Classification, Newfoundland and Labrador, 1962

Classification	Island	Labrador	Total	% of Total Area
	------ thousand acres ------			%
Productive forest land:				
Softwood - Merchantable	4,272	11,358	15,630	16
Young growth	3,231	504	3,735	4
Mixedwood- Merchantable	258	-	258	-
Young growth	172	-	172	-
Hardwood - Merchantable	6	-	6	-
Young growth	156	-	156	-
Unclassified 1/	215	1,500	1,715	2
Total productive forest land	8,310	13,362	21,672	22
Non-productive forest land	6,278	28,237	34,515	35
Total forest land	14,588	41,599	56,187	57
Non-forest land	11,757	23,605	35,362	35
Total land area	26,345	65,204	91,549	92
Water	1,405	7,005	8,410	8
Total area	27,750	72,209	99,959	100

1/ Includes areas of recent burn, cut-over, or windfall, not yet restocked. The 1967 estimate for the Island is over 2 million acres of unsatisfactorily stocked productive forest land (Forest Service).

Source: Canadian Forestry Statistics, 1962. D.B.S.

A classification of productive forest land by ownership (limit or concession holder) is given in Table 4-3. The best current data on the forests of Labrador have been compiled by the federal Department of Forestry (Wilton, 1964). Table 4-4 shows areas of land and water in the various forest zones (vegetative classes) in Labrador.

TABLE 4-3

Estimated Area of Productive Forest Land by Ownership, Newfoundland and Labrador, 1967

Limit or Concession Holder	Island	Labrador	Total
	-------- thousand acres -----		
Crown	1,000	4,767	5,767
Bowaters (Newfoundland) Ltd.	3,000	345	3,345
Price (Nfld.) Pulp and Paper Ltd.	2,077	-	2,077
Newfoundland Pulp and Chemical (NPCC) 1/	1,880	4,718	6,598
Private and other	423	-	423
Newfoundland and Labrador Corp. (NALCO) 1/	-	2,680	2,680
British Newfoundland Corp. (BRINCO) 1/	-	852	852
Total	8,380	13,362	21,742

1/ Crown lands under concession for timber rights.

Source: Newfoundland Forest Service.

TABLE 4-4

Area Classification by Vegetative Zones, Labrador

Vegetative Class	Zone	Land Area	Inland Waters
		--- thousand acres ---	
Excellent forest	1	432	96
Good forest	2	5,960	326
Marginal and fair forest	3	18,429	1,390
Scrub and unmerchantable forest	4	18,413	3,279
Arctic and coastal tundra	5	21,716	1,502
Total		64,950	6,593

Source: Wilton, W.C. The Forests of Labrador. Canada Department of Forestry. Pub. No. 1,066. Ottawa, 1964.

Estimated Wood Volume

Pending the results of the provincial forest inventory, to be completed in 1970, volume estimates tend to vary widely. The latest estimates of merchantable volume are presented in Table 4-5, with distribution of total stands by species in Table 4-6.

TABLE 4-5

Estimates of Merchantable 1/ Standing Volume, Newfoundland and Labrador, 1967

Classification	Island	Labrador	Total
	------ million cords -------		
Softwood	54	74	128
Hardwood	6	4	10
Total	60	78	138

1/ Stands containing more than 5 cords per acre of trees greater than 4" d.b.h.

Source: Newfoundland Forest Service.

TABLE 4-6

Estimates of Total Stand Composition, Newfoundland and Labrador

Species	Island	Labrador
	per cent of total volume	
Balsam fir	50	20
Black and white spruce	37	71
White and yellow birch	10	5
Larch	2	4
White and red pine	1	-

Source: Newfoundland Forest Service.

Wilton (1964) subdivided the more southerly and coastal part of Labrador, which contains the relatively accessible and merchantable forests, into major watersheds and zones. Areas and timber volumes are listed in Table 4-7 and locations illustrated in Map 7.

TABLE 4-7

Timber Volume on Relatively Accessible Watersheds, Labrador, 1964

Watershed	Vegetative Zone 1/	Area	Total Volume
		000 acres	000,000 cords
Alexis Bay	2	521	6.4
	3	395	3.2
Sub-total		916	9.6
Sandwich Bay	2	283	3.5
	3	710	5.7
Sub-total		993	9.2
Lake Melville	1	229	4.2
	2	782	9.6
	3	1,150	9.2
Sub-total		2,161	23.0
Kaipokok Bay	2	219	2.7
	3	288	2.3
Sub-total		507	5.0
Total		4,577	46.8

1/ See Table 4-4.

Source: Wilton (1964).

A tentative age-class distribution of softwood species on the Island, by area and volume, is presented in Table 4-8.

TABLE 4-8

Age-Class Distribution, Softwoods, Productive Forest Land, Newfoundland (Island), 1967

Age Class	Area	Volume	Volume Per Acre
	000 acres	000 cords	cords
0 - 40	3,688	-	-
41 - 80	2,219	19,500	8.8
81 +	2,473	35,100	14.2
Total/Average	8,380	54,600	6.5

Source: Newfoundland Forest Service.

Growth, Loss and Stability

Annual Growth Rates

Although a number of growth studies have been carried out, particularly by the federal Department of Forestry, e.g.,Wilton (1956), Wilton and Lewis (1956), Wilton (1964), van Nostrand (1964), their application is restricted because of a lack of inventory data to which the growth rates may be applied. Added to this is the problem that many of the younger stands have been cut or burned before they reached the culmination point of mean annual increment. Indeed, in some instances in the studies mentioned above, even the culmination point of the periodic annual increment could not be determined.

Based on historical evidence, there is no doubt that the productivity of large areas of forest land has deteriorated as a result of wildfires, and virtual clear-cutting has increased the exposure of many forest sites. Moreover, cut-overs often are regenerated by dense balsam-fir stands, which need thinning if the next crop is to be harvested in a reasonable number of years. In some areas repeated or severe forest fires have destroyed the productive capacity of the site for many years, even decades, by burning the humus layer and exposing the bare rock. Such sites may have become permanently unproductive.

Because of the lack of comprehensive growth data, it is necessary to accept the growth rate, assumed by the Kennedy Commission (1955) for the entire Island, of 0.18 cords per acre per year. It should be stressed that this average applies to areas of merchantable softwood volumes, assuming a rotation age of 80 years. This estimate of mean annual increment is the best available for the Island, and is still used for policy-making decisions by the provincial government.

There is no doubt, however, that with the application of more intensive forestry practices the growth rate could be doubled for much of the forest land now bearing merchantable timber. In addition, other lands could be converted to commercial production by the application of cultural practices, such as seeding, planting, fertilization and drainage, if and when such investments become economically feasible.

For Labrador, Wilton (1964) has calculated the mean annual merchantable increments (Table 4-9). Wilton indicates that only in Forest Zone I, the "excellent forest" zone, can the increments be accepted with confidence at the present time.

In Table 4-2 it was shown that, in Labrador, 1.5 million acres are unclassified, which includes areas of recent burns, cut-over or windfall. This represents 11 per cent of the total productive forest area. On the Island it was estimated that 215,000 acres belong to this category, representing 2.6 per cent of the productive forest area. The Newfoundland Forest Service, however, estimates that as much as 2.0 million acres of land on the Island not now bearing commercial forest, could be reforested or afforested, though the economic rationale for such action has not been established.

TABLE 4-9

Mean Annual Merchantable Increment, Labrador

Site Class 1/	Forest Zone 1	2	3	4
	------ cubic feet per acre -----			
I	34	20	-	-
II	17	12	8	7
III	5	4	3	2

1/ Site Class: I: Forest type: Fir-Spruce-Birch/ Rich Herb.

II: Spruce-Fir/Feathermoss.

III: Spruce-Sphagnum.

Source: Wilton (1964).

Disease and Insects

Among factors affecting forest stability, tree diseases are less spectacular than insects and fire; however, they cause equally significant forest losses. Disease organisms cause rapid deterioration of trees killed or severely injured by insect attack. The estimated period for salvaging insect-killed timber is from two to four years and for fire-killed timber up to six years.

The two most important forest insects endemic to Newfoundland are the balsam woolly aphid and the hemlock looper. Both have assumed epidemic proportions in recent years and currently (1967-68) the combined effect of the over-maturity of many timber stands and an epidemic of the aphid followed by a severe hemlock looper infestation in western Newfoundland is causing widespread mortality of balsam fir. Chemical control measures are expected to be necessary in 1968 in order to arrest the current epidemic of this insect which, in 1967, was estimated to have killed over one million cords of merchantable timber between the northern end of Grand Lake and Port aux Basques.

Fire

Because of large areas of unoccupied and relatively inaccessible land, forest fires are a major hazard. Considering the vastness of the forest area involved, organization for the protection of the forests from fire is very good. Particularly since the disastrous forest fire season of 1961, much has been done to prevent outbreaks of such proportions. In Table 4-10 are data showing forest areas burned, classified by forest types, for the calendar years 1947 to 1967. On the average,

21 per cent of the area burned carried merchantable timber stands, 69 per cent was waste land. Annual expenditures for forest fire protection and suppression, by the two operating companies and the Forest Service, are given in Table 4-11 for the years 1958 to 1967, inclusive.

TABLE 4-10

Classification of Forest Areas Burned, by Forest Types, Newfoundland, 1/ 1947-1967

Year	Waste	Recent Burn	Young Growth	Cut-Over	Merchantable	Total 2/
	----------------	t h o u s a n d		a c r e s	----------------	
1947	193.6	5.2	29.4	37.4	39.2	304.8
1948	0.1	-	-	-	-	0.2
1949	18.6	0.9	1.1	11.5	5.4	37.5
1950	47.8	1.2	12.0	4.8	7.6	73.3
1951	5.7	-	3.7	1.6	2.6	13.6
1952	14.9	-	1.2	8.4	6.1	30.7
1953	0.5	-	0.1	0.8	-	1.4
1954	0.2	-	0.1	1.5	-	1.8
1955	3.4	-	0.7	0.3	0.3	4.7
1956	0.8	-	0.2	1.9	-	2.9
1957	19.4	-	1.1	1.1	0.2	21.9
1958	2.4	-	0.1	-	-	2.6
1959	9.7	-	1.1	10.4	13.0	34.2
1960	51.3	0.4	9.6	7.7	1.8	70.7
1961	592.6	17.4	54.3	36.4	364.9	1,065.5
1962	10.5	0.5	1.4	-	3.2	15.6
1963	3.7	-	0.1	1.3	-	5.2
1964	286.3	-	0.7	0.1	71.2	358.2
1965	1.6	-	0.2	0.3	-	2.2
1966	4.2	-	-	-	-	4.3
1967	563.3	-	0.1	0.1	48.4	612.0
Total 2/	1,830.4	25.7	117.2	125.8	564.1	2,663.4
Average Year	87.2	1.2	5.6	6.0	26.9	127.0
Per Cent	69	1	4	5	21	100

1/ For 1960 et seq. the statistics include Labrador.
2/ Lines and columns may not add exactly due to rounding.

Source: Newfoundland Forest Protection Association, Annual Reports, Table E-2.

TABLE 4-11

Forest Fire Protection and Suppression Costs,
Newfoundland and Labrador, 1958-1967

Year	Price	Bowaters	Forest Service	Total
	---------- thousand	dollars	----------	
1958	122	97	243	462
1959	171	171	177	519
1960	199	133	263	595
1961	395	392	561	1,348
1962	131	150	511	793
1963	106	141	844	1,091
1964	125	159	528	812
1965	124	164	797	1,085
1966	116	164	1,139	1,419
1967	118	140	2,114	2,372
Total	1,607	1,711	7,177	10,495
Average	161	171	718	1,050

Source: Newfoundland Forest Service, 1968.

The various causes of forest fires are shown in Table 4-12. In 1964 and 1967 lightning was the major cause.

There does not appear to be any regular periodicity of years of high fire loss, though it is of some interest to note in the Kennedy Commission Report (1955, p. 66) that "peak fire hazard years (may) occur at intervals of 10 to 15 years ...." Since 1947 was one such year, the tremendous area burned in 1961 would lend support to the Commission's conjecture. On the Avalon Peninsula, an estimated 2.5 million cords of pulpwood were destroyed in the 1961 fire.

Weather conditions, both on the Island and in Labrador, are the prime determinant of the extent of forest areas burned each year.

Other Factors Affecting Stability

Climatic conditions, a short growing season and cool temperatures are considered to be important factors limiting tree growth in Newfoundland.

Balsam fir is the climatic climax species throughout much of the Island. After cutting operations, especially in the absence of fire, reproduction of balsam fir tends to be abundant and often too dense for normal stand development. In western Newfoundland, hardwood trees may occupy some sites for one generation, but ultimately balsam fir will succeed as the climax species. On the moister sites, especially those with imperfect drainage, black spruce persists. Although the more desir-

TABLE 4-12

Area of Fires by Causes, Newfoundland and Labrador, 1961-1967

Causes	1961		1962		1963		1964		1965		1966		1967	
	000 acres	%	000 acres	%	000 acres	%	000 acres	%	000 acres	%	000 acres	%	000 acres	%
Railway	19.8	2	-	-	-	-	-	-	0.1	5	-	-	-	-
Workers	565.2	54	-	-	4.5	87	0.1	-	0.2	11	-	-	-	-
Settlers	1.8	-	0.1	1	-	1	-	-	-	1	-	-	-	-
Campers	308.0	34	13.7	88	-	-	-	-	-	-	0.6	14	-	-
Berry Pickers	55.4	5	-	-	-	-	-	-	0.1	5	-	-	0.3	-
Fishermen	0.2	-	0.2	5	0.2	4	0.6	-	0.2	8	0.1	1	-	-
Travellers	14.8	1	0.1	1	-	-	1.0	1	0.1	5	-	-	-	-
Incendiary	0.1	-	-	-	-	-	-	-	0.1	3	-	-	-	-
Lightning	19.8	2	-	-	-	1	356.0	99	-	-	1.8	41	610.4	100
Miscellaneous	0.1	-	0.5	3	-	-	0.5	-	0.1	2	1.5	36	0.2	-
Unknown	17.5	2	0.2	2	0.4	7	-	-	1.3	60	0.3	7	1.1	-
Total	1,002.7	100	14.8	100	5.1	100	358.2	100	2.2	100	4.3	100	612.0	100

Source: Newfoundland Forest Protection Association, Annual Reports, Tables C and D.

able spruce species may be encouraged to reproduce naturally following selective cutting and scarification of the drier, more productive sites, only clear-cutting is feasible if modern mechanical harvesting methods are to be employed economically.

The Bay d'Espoir Power Development on the Island will cause the flooding of some 32,400 acres of productive forest land, 125,800 acres of land in all (Newfoundland Forest Service). Assuming an average stand-volume for the Island of seven cords per productive acre, the merchantable timber volume inundated would amount to 230,000 cords. An additional 100,000 cords will become more inaccessible as a result of the flooding. It is estimated that the additional cost of salvaging this timber will amount to $7 per cord.

Sustained Annual Yield Potential

Pending the completion of the provincial forest inventory, only a rough estimate of the annual-yield potential can be made. Present estimates indicate an annual allowable cut of 1.6 million cords of softwood on the Island and another 1.6 million cords in Labrador.

In Table 4-8, the average merchantable volume in mature softwood stands on the Island was shown to be 14.2 cords per acre. Although softwoods have been used primarily for pulpwood in the past, at least 15 per cent of the wood currently cut as pulpwood would be suitable for the manufacture of lumber in efficient, highly-automated sawmills. However, even with integrated use of softwood stands for sawlogs and pulpwood, the average yield per acre might be expected to be of the order of 14 to 15 cords-equivalent.

In western Newfoundland, however, hardwoods comprise an estimated 6 million cords, 10 per cent of the Island's merchantable standing volume. (See Table 4-5.) As the pulp and paper companies have developed no use for hardwoods, these trees, predominantly white birch, have been left standing in the cut-over areas. The yield potential of hardwood sites is therefore unrealized in current cutting operations and the residual hardwood trees are left to seed in the adjoining areas.

The fuller utilization of western Newfoundland's forest potential, use of not only its softwood sawlogs but also its appreciable volume of hardwoods, will come only after major changes are made in forest land tenure and forest-harvesting techniques.

2. TENURE AND PRODUCTION

Timbersheds of Pulp and Paper Companies

Because of the nature of the forests and the changing conditions respecting ownership or control of the forests, available estimates of the extent of pulp and paper company limits tend to differ. Some of the variation is attributable to changing definitions. In Table 4-3 it was shown that two pulp and paper companies own or control over 5 million acres, or about 60 per cent of the productive forest land on the Island. Of the remainder, most is Crown land, of which 1.9 million acres, or two-thirds, has been committed to the Newfoundland Pulp and Chemical Company. (See also Map 8.)

The companies' own assessments of their limits are presented in Table 4-13.

TABLE 4-13

Area Classification of Pulp and Paper Company Lands, Newfoundland, 1966

Area Classification	Bowaters 1/	Price	Total	Island	% Company Controlled
	---------- thousand acres ----------				%
Merchantable	1,821 2/	1,111	2,932	4,536	65
Non-merchantable	1,576	966	2,542	10,052	25
Total forest	3,397	2,077	5,474	14,588	37
Non-forested	4,399	2,310	6,709	11,757	57
Total land area 3/	7,796	4,387	12,183	26,345	46

1/ No adjustment made for lands returned by Bowaters to Crown in 1966.
2/ Merchantable areas burned in 1959 and 1961 not deducted.
3/ 28.4% of Bowaters' lands and 2.0% of Price lands classed as inaccessible.

Source: Company returns, 1966.

In Table 4-13 it will be noted that merchantable forests occupy only slightly more than half the total area of company-controlled forested lands, and that these forests constitute 65 per cent of total merchantable forests. 1/

1/ Merchantable forests are understood to include those stands supporting five cords or more of pulpwood per acre that are over 40 years old.

Estimated Volume

Estimates of timber volume are from company inventories. Price (Nfld.) Ltd. cruises have been up-dated by assuming an average growth rate of 0.18 cords per acre per year, the rate assumed by the Kennedy Commission (1955), and more recently by assuming a growth rate of 0.24 cords per acre per year. Bowaters' estimates of wood volume are made almost exclusively on the basis of photo-estimates; a control is maintained by checking the estimated number of cords against the number of cords actually harvested. Not until the provincial forest inventory is completed will more reliable data be available.

Table 4-14 presents estimates of areas and volumes by age groups on productive forest lands for the two existing pulp and paper mills, as well as for private holdings and for Crown lands.

TABLE 4-14

Age-Class Distribution, Newfoundland, 1967

Age Class	Bowaters	Price	Crown	Private	Total
years	--------	thousand acres		--------------	
0 - 40	1,230	682	1,660	92	3,664
41 - 80	330	600	1,020	243	2,193
Over 80	1,440	795	200	88	2,523
years	--------	thousand cords		--------------	
0 - 40	-	-	-	-	-
41 - 80	3,100	5,700	9,700	1,000	19,500
Over 80	18,000	13,800	2,600	700	35,100

Source: Newfoundland Forest Service, 1967.

In addition, Newfoundland Pulp and Chemical Company has a concession on Island timber plus a concession area in Labrador involving some 24 million cords of softwoods, both over existing Crown lands (Table 4-15).

Estimated Cut

Bowaters (Newfoundland) Ltd. The actual volume of pulpwood cut by Bowaters (Newfoundland) Ltd. has averaged 491,000 cords for the period 1962-66 (Table 4-16). It is interesting to note that this coincides almost exactly with the Kennedy Commission's (1955) estimate of this company's allowable annual cut of 492,000 cords. However, only since 1964 has the yearly cut exceeded this admittedly conservative figure. The presence of extensive areas of undeveloped mature and over-mature timber in western Newfoundland is mute evidence that Bowaters has been consistently undercutting its limits or paying inadequate attention to the principle that over-mature stands should be assigned high priority

TABLE 4-15

Softwood Volume in Productive Forest, Labrador, 1/ 1962

Concession Holder	Softwood Volume
	million rough cords
Newfoundland & Labrador Corp. (NALCO)	30
British Newfoundland Corp. (BRINCO)	10
Newfoundland Pulp & Chemical Co. (NPCC)	24
Unalienated Crown land	10
Total	74

1/ East of Lat. 63° W, south of Long. 55° N.

Source: Newfoundland Department of Mines, Agriculture and Resources. Annual Report, 1962.

TABLE 4-16

Estimated Cut by Bowaters and Price, 1962-1966

Year	Bowaters				
	Domestic	Export	Total	Price	Total
	thousand cords				
1962	235	74	309	266	575
1963	287	72	359	334	693
1964	477	126	603	291	894
1965	510	103	613	296	909
1966	481	88	569	336	905
Total	1,990	463	2,453	1,523	3,976
Average	398	93	491	304	795

Source: Newfoundland Forest Service, 1967.

in the harvesting sequence. At present a sharply increased rate of cutting is essential in west coast forests, especially in stands where overmature balsam fir predominates. As the Bowaters mill can use a maximum of only 200,000 cords of this species annually, it is urgently necessary to seek immediate and large-scale use of balsam fir during at least the next decade.

Price (Newfoundland) Pulp & Paper Ltd. The estimated cut of pulpwood by Anglo-Newfoundland Development Company, now Price (Nfld.) Pulp & Paper, is summarized by decades for the period 1908-1966 in Table 4-17, and annually for the period 1962-1966 in Table 4-16 (above). This company has increased its annual cut from 110,000 cords in its first decade of operation to 304,000 cords in the last five years for which statistics are available. Since both the Kennedy Commission's estimated allowable cut of 376,000 cords and the company's estimate of 354,000 cords are in excess of the actual cut, it seems clear that Price could increase its annual cut without depleting its forest resource.

TABLE 4-17

Estimated Cut by Anglo-Newfoundland Development/Price (Nfld.) Pulp and Paper Ltd., 1908-1966

Period	Volume Cut	No. of Years	Average Annual Cut
	cords	no.	thousand cords
1908-1916	988,500	9	110
1917-1926	1,157,500	10	116
1927-1936	1,627,500	10	163
1937-1946	1,865,343	10	187
1947-1956	2,820,694	10	282
1957-1966	2,918,150	10	292
Total/Average	11,377,687	59	193

Source: Newfoundland Forest Service, 1967.

Other Crown Lands (Newfoundland)

Nearly all the balance of forested land on the Island is held by the Crown. 1/ Tunstell (1957) estimated that, of the 14.0 million acres of unalienated Crown lands, 3.0 million were to be considered productive forest lands, of which 1.3 million acres were then merchantable.

Since 1960 a concession over all vacant Crown lands on the Island has been held by Newfoundland Pulp & Chemical Company as a guarantee of pulpwood supplies for a mill at Come by Chance on the isthmus of the Avalon Peninsula.

1/ The provincial government estimates that about 37,000 acres of productive forest lands are privately owned.

Estimated Volume

Table 4-18 shows the best estimates of the forest inventory on Crown lands for the Island of Newfoundland in 1959.

TABLE 4-18

Forest Inventory on Crown Lands, Island of Newfoundland, 1959

Area	Productive Forest Area 1/		
	Merchantable 2/	Unmerchantable 3/	Merchantable Volume 4/
	thousand acres		thousand cords
East Coast: Come by Chance to Flower's Cove	726	813	7,066
West Coast: Flower's Cove to Humber River	360	367	4,290
South Coast: Bay d'Espoir Area to Come by Chance	111	146	906
Avalon	118	364	1,060
Total	1,315	1,690	13,322

1/ Productive forest land currently supporting a timber crop of any age.
2/ Merchantable stands carrying 5 cords or more of pulpwood per acre and over 40 years old.
3/ Unmerchantable stands are 40 years old or less, and/or have less than 5 cords of pulpwood per acre.
4/ Merchantable cord means 128 cubic feet stacked measure taking stems 4" + d.b.h. to a 3" top and stump height of 1 foot. It presumably includes both softwoods and hardwoods.

Note: See also Map 5.

Source: The Jenkins Forest Survey.

Estimated Cut

The latest estimates available of drain on Crown lands are for the year 1965:

19,275	cords of pulpwood for domestic consumption
35,925	cords of pulpwood for export
56,091	cords-equivalent for lumber production
150,000	cords of fuelwood and other local uses
261,291	cords total

These are rough estimates only. Some of this wood - particularly fuelwood - comes from "unproductive" Crown lands. The fuelwood cut is generally thought to be decreasing.

Since 1958, a number of forest-management areas have been established in the unalienated Crown forests to regulate and improve the drain on Crown forests. Under good management, it was estimated by Munro (1961) that the future annual cut could be more than doubled:

1959-1968:	293,000 cords
1969-1998:	499,000 cords
1999-2028:	671,000 cords

Munro states:

> "Good management presumably means direction of fuelwood cutting away from the pulpwood and potential pulpwood stands, to lower value birch and scrub. This would leave the better sites free for pulpwood production. Part of the fuelwood cut could clean up birch and cull which now often rot after pulp or sawlog operations. If the mature but inaccessible timber could be logged, these areas would again grow useful wood. With greater access, unsalvageable losses could be reduced. Unless effective control accompanies greater access, however, it only makes more wood open to destructive cutting."

Effect of Tenure on Forest-Management Practices

Pulp and Paper Mill Concessions

While some further utilization of the forest potential of Newfoundland is possible through the expansion of the existing pulp and paper mills and the establishment of a third mill, the rate of development and its extent are severely limited by the present tenure of the two pulp and

paper companies. Resolution of this problem is essential if there is to be diversification of the forest-based industries and maximum utilization of the province's forest potential, the major resource of the Island.

The original acts were passed prior to Confederation, in an economic climate vastly different from that of today. There was little or no competition for wood at that time. Newfoundland needed industrial investment and was willing to make sweeping concessions in order to attract it. The lack of clauses providing for periodic re-examination of the agreements was short-sighted. Although the Kennedy Commission was reluctant to come to grips with the problem, it did acknowledge that "the returns to the province from its forest resources have been picayune compared to what other provinces would receive under similar circumstances."

Having absolute control over the wood supplies on their respective limits, the companies do not practice any form of forest management. The fiction of an allowable annual cut is perpetuated by going through the motions of making this calculation without knowledge of the actual amount of merchantable wood currently available or the rate of growth. Little attention is paid to the establishment of the next forest crop when a stand is harvested; nevertheless, natural regeneration of certain tree species is usually abundant.

Sawlog-sized trees on the companies' licensed lands are not generally made available to sawmill operators; instead, these trees are converted into pulpwood. If it is desirable to maintain a sawmilling industry, then access to sawtimber on company limits will be necessary. At present the companies are under no obligation either to utilize sawlogs for lumber production themselves, or to sell them to sawmill operators.

Though a lesser facet of the tenure problem, the fragmentation of the licensed lands of the two companies imposes a financial burden on the companies, due to long-distance movement of wood to the respective mills (shipments often passing one another en route), and an administrative burden on the Forest Service. Consolidation of the licensed areas would be of considerable advantage to all parties.

There would appear to be three possible solutions to the problem: renegotiation of the existing agreements; amendments to the present acts; or revesting the companies' granted lands in the Crown, with a guarantee to the companies of sufficient wood for their present and future needs. Renegotiation and amendments could include establishment of royalties and, possibly, ground rent, reassessment of the area of forest land necessary to support each mill, consolidation of the licensed areas, and steps toward placing the lands under sound forest management.

An argument commonly advanced by the pulp and paper companies to justify the holding of large areas of land under licence is that control of forest land is essential collateral for obtaining loans in the "financial markets of the world". This argument is not supportable. The control which a company exerts over its wood supply derives, not from the land on which the wood is growing, but from the legislative act granting permission to the company to utilize the wood. As long as title to the land remains

vested in the Crown, the legislature has the authority to amend the act. It follows that comparable security would result from an act guaranteeing the company an annual supply of wood from Crown lands; in other words, the company need not have any licensed land at all.

Nevertheless, implementation of any changes will not be easy. The conclusion of the Kennedy Royal Commission is still valid: "The whole problem is extremely involved and only sympathetic negotiations between the Government of Newfoundland and the two companies involved would seem to offer an amicable and realistic settlement of the various factors, with legal action as a last resort."

Statutory Cutting Rights

The Crown Lands Act grants statutory rights to residents to cut timber for their own use. Section 89 reads as follows:

> "No person shall cut or remove any trees from Crown Lands, except a maximum of two thousand cubic feet of timber cut for his own use, as firewood, in the fishery, in agriculture, or in other occupations of a similar nature, unless he has obtained a permit from the Minister issued in accordance with this Act and the regulations".

Note that no restriction is placed on area or time. The amount of timber to be cut without a permit for one's own use can be interpreted to mean per year, month or week. Nor is cutting restricted to the three-mile limit, a term applied to lands within three miles of tidal water, originally intended for the purpose of providing citizens with timber. A clause in the Crown land licences granted to the two pulp and paper companies provides for the right of residents to cut timber for their own use, under the conditions specified in the Act. No distinction is made in this respect between Crown lands under licence and unalienated Crown lands. Timber is cut "for own use" without regulation or supervision and under a minimum of inspection.

In 1954 important management legislation was added to the Crown Lands Act, allowing the proclamation of Forest Management Areas. On these Areas, for which the property boundaries are established and well marked, domestic and commercial cutting is allowed only with a permit and under very specific instruction with regard to area, time, cutting methods and kind and size of trees.

3. PULP AND PAPER

Newfoundland has two producing pulp and paper mills, and two more are planned. Bowaters Ltd. is located at Corner Brook on the west coast; Price Pulp and Paper Co. Ltd. is located at Grand Falls, about 20 miles from ocean-shipping facilities. (Price operates its own railroad from Grand Falls to Botwood.) Both produce mainly newsprint. A third newsprint mill has been announced for Come by Chance, and a fourth mill, a kraft pulp and linerboard mill, for Stephenville. (*See* Map 5.)

As planned, the Come by Chance mill will produce 600 tons of newsprint per day, at a capital cost of $57 million. The mill announced for Stepehenville is to have a planned output of 1,000 tons per day, with wood input in the form of chips supplied from a mill in Labrador. Capital investment is reported to be $120 million. It is estimated that these new plant facilities will require an additional one million cords of wood and will generate direct employment in the mills of 2,000 people. It is predicted that an additional 6,000 man-days will be required in the woods operations.

Table 4-19 summarizes principal operating statistics for the two existing mills. 1/ The two mills combined produced an estimated 647,000 tons of paper and pulp products valued at $85 million in 1964. Annual wood consumption is estimated at 820,000 cords. Bowaters operated at 90 per cent, and Price at 80 per cent, of capacity in the year examined.

In addition to newsprint, the mills sell an estimated 54,000 tons of sulphite pulp and some 30,000 tons of specialty papers annually.

Inputs

The total amount of wood consumed in both existing mills was estimated at 817,000 rough cords of softwoods in 1966 (Table 4-20). All wood comes from company limits. This is cited as a disadvantage for the operating companies, since purchased wood tends to be cheaper.

1/ Some data were obtained from the companies themselves, some from the Financial Post Survey of Industrials (1965); others were derived. Not all are reliable (e.g., "wood consumption" was derived by applying "rough cords per ton" to annual production).

TABLE 4-19

Pulp and Paper Industry, Newfoundland, 1964

Location	Type of Mill	Capacity Day	Capacity Year	Production 1/ Day	Production 1/ Year	Value	Wood Used 2/	Plant Labour	Daily Output 3/	Production as % of Capacity	Rough Cords per ton
		tons	000 tons	tons	000 tons	million $	000 cords	no.	ton/man	%	cords
Bowaters	Newsprint	1,260	366	1,125	330	44	396	1,420	0.79	90	1.2
	Sulphite	375	108	150	45	5	90	-	-	-	2.0
Sub-total		-	-	-	375	49	486	-	-	-	-
Price	Newsprint	990	287	800	263	35	316	1,080	0.74	80	1.2
	Sulphite	250	73	-	9	1	18	-	-	-	2.0
Sub-total		-	-	-	272	36	334	-	-	-	-
Total		-	-	-	647	85	820	-	-	-	-

1/ Production of salable products.
2/ Wood utilization of salable products.
3/ Newsprint.

Source: Company returns; Financial Post Survey of Industrials (1965).

TABLE 4-20

Fibre Inputs, Pulp and Paper Mills, Newfoundland, 1962-1966

Year	Bowaters	Price	Total
		000 cords	
1962	235	266	501
1963	287	334	621
1964	477	291	768
1965	510	296	806
1966	481	336	817
Total	1,990	1,523	3,513
Average	398	304	702

Source: Newfoundland Forest Service.

There is little likelihood that hardwoods will be utilized in the existing mills in the foreseeable future. The announcement of the proposed construction of a linerboard plant in Stephenville, however, augurs well for the possible utilization of hardwood species, especially on the west coast where transportation distances will be relatively short.

Bowaters employs about 1,800 people in the mill (about 1,420 are production employees) and 3,000 men in the woods. Price employs about 1,300 people in the mill (about 1,080 in production), 3,000 men in the woods and 200 in the shipping organization. Shift workers are fully employed throughout the year; they work an average of 42 hours but are paid for 45 hours per week. Wage rates at Bowaters range between $2.63 and $5.46 per hour.

In its submission to the Royal Commission on the Economic State and Prospects of Newfoundland and Labrador (1966), Price stated that "the labour content per ton of product was 8.60 man-hours for the Company compared to an industry average of 7.22." No similar data are available for Bowaters.

Bowaters estimates that 1.25 to 1.30 rough cords of pulpwood are required for each ton of newsprint.

A more detailed breakdown of wood utilization figures was given by Price:

Product	No. of Peeled Cords per ton	No. of Rough Cords per ton
Groundwood	0.9	1.0
Sulphite	1.8	2.0
Newsprint	1.1	1.2

With respect to other inputs, each existing mill has its own facilities for producing power. D.B.S. lists the cost of fuel and electricity for the two mills combined at $6 million in 1964. The total cost of materials and supplies in 1964 was $30 million.

Output

Production and export of forest products are summarized annually by the Newfoundland Department of Mines, Agriculture and Resources; it is not possible, from the published data, to separate production from exports. A summary of the value of production for various products is given in Table 4-21 for the years 1953 through 1965.

TABLE 4-21

Value of Pulp and Paper Production, Newfoundland, 1953-1965

Year	Newsprint	Sulphite	Pulpwood	Other	Total
	thousand dollars				
1953	56,299	4,214	2,632	-	63,135
1954	55,124	4,877	3,218	-	63,219
1955	62,634	6,436	3,066	201	72,337
1956	65,716	6,785	2,822	912	76,235
1957	61,901	6,283	2,952	587	71,723
1958	59,214	5,325	1,395	659	66,593
1959	61,411	4,792	2,239	1,138	69,580
1960	-	-	-	-	73,788
1961	71,648	4,242	2,846	1,870	80,606
1962	67,184	4,602	2,789	711	75,286
1963	72,256	3,866	2,283	1,405	79,810
1964	74,060	5,083	3,705	4,214	87,062
1965	74,710	4,354	3,942	4,349	87,355

Source: Newfoundland Department of Mines, Agriculture and Resources. Annual Reports.

Virtually the entire production of pulp and paper products is exported. No information is available about Bowaters' sales. It is believed that the annual production of 330,000 tons of newsprint and 45,000 tons of baled sulphite pulp is mainly marketed in the United States and in the United Kingdom. The destinations of Price's products are shown in Table 4-22.

TABLE 4-22

Shipments by Market Areas, Price (Nfld.) Ltd., 1964

Country or Region	Volume	
	tons	%
U.S.A.	91,863	34.3
United Kingdom	89,466	33.4
Latin America, Caribbean	80,971	30.2
Australia	3,099	1.2
Philippines	1,906	0.7
Domestic	504	0.2
Total	267,809	100.0

Source: Company returns.

4. SAWMILLING

The sawmilling industry today is essentially similar to that described in the report of the Kennedy Commission (1955).

Of a total of 1,100 licensed sawmills in 1966, only one produced over 1.0 million f.b.m. of lumber annually; approximately 11 others produced over 200,000 f.b.m. The vast majority are still push-bench family units, operated seasonally by fishermen to supply local needs from sawlogs cut in the three-mile Crown shoreline reserve. Table 4-23 shows the distribution of sawmills by size class in 1961.

About one-quarter of the mills licensed in a given year do not operate (Table 4-24). Sawmill licences are issued by the Department of Mines, Agriculture and Resources (D.M.A.R.) in three administrative regions on the Island - Eastern, Central and Western - and for Labrador. The licence fee is a flat $20.00 per annum, regardless of size of mill.

Despite the fact that an average of 81 new mills have been licensed each year for the past five years, the total number of mills, licensed and operating, has declined by about 100 each year since 1963 (see Table 4-24).

TABLE 4-23

Sawmill Distribution by Size Class, Newfoundland, 1966

Annual Production	Sawmills Licensed	
thousand f.b.m.	no.	%
Less than 10	687	52
10 - 25	290	22
25 - 50	159	12
50 -100	106	8
100-200	53	4
More than 200	26	2
Total	1,321	100

Source: Information supplied by the Minister of Mines, Agriculture and Resources in reply to Question No. 119, Order Paper dated March 9, 1966, Newfoundland Legislative Assembly.

TABLE 4-24

Sawmill Licences Issued by Region, Newfoundland, 1955-1965

Year	Region					Total Licences	New Licences		Not Operating	Operating	Total
	East	Central	West	Labrador	Total						
	%	%	%	%	%	no.	no.	%	%	%	%
1955						1,419					
1956						1,609					
1957						1,631					
1958						1,654					
1959						1,591					
1960						1,353					
1961	42	23	34	1	100	1,352	95	7	26	67	100
1962	44	24	31	1	100	1,308	80	6	23	71	100
1963	41	24	34	1	100	1,456	114	8	22	70	100
1964	37	25	36	2	100	1,217	57	4	25	71	100
1965	43	27	28	2	100	1,128	60	5	29	66	100
Total						15,718	406				
Av.	41	25	33	1	100	1,429	81	6	25	69	100

Source: Newfoundland Forest Service.

Inputs

The origin of sawlog supplies, by region, is summarized in Table 4-25 for the years 1964 and 1965. Between 75 and 80 per cent of the sawmills are dependent upon Crown sawlog stumpage, 15 per cent upon private stumpage, 10 per cent upon both.

Most of the sawmills are therefore dependent upon Crown lands - especially the three-mile coastal reserve - for their sawlog inputs. Much of the forest cover in this coastal strip is unsuitable for the production of sawtimber, and the more accessible and larger trees have already been cut for sawlogs, fuel or other uses. Moreover, residual Crown lands tend to include a larger proportion of non-productive or inferior forest growth.

In effect, the limits held by the two existing pulp and paper companies include a large share of the potential sawlog supply. Moreover, the terms of present pulp and paper company leases do not require that the larger trees or logs be cut for sawlogs. Consequently there is virtually no integrated utilization of sawlogs and pulpwood.

The seasonality of sawmilling activity in Newfoundland and Labrador renders difficult the collection and analysis of labour statistics. The Minister of Mines, Agriculture and Resources (1966) stated that 100,000 man-days were involved in lumber production in 1965 compared with 163,000

TABLE 4-25

Sawmills Classified by Crown or Private Ownership of Sawlog Supplies, by Region, Newfoundland, 1964 and 1965

Year	Number of Dependent Operating Sawmills									
	Private Supplies				Private and Crown Supplies				Crown	Total
	East	Central	West	Total	East	Central	West	Total	Total	
1964	22	31	81	134	20	15	9	44	722	900
1965	19	31	72	122	23	18	26	67	598	787

Source: Newfoundland Forest Service.

in 1950. For 1965 he reported that 1,111 sawmills were licensed; 1/ for 1950, 1,148.

It is clear that the vast majority of Newfoundland's sawmills are small and inefficient. Furthermore, few, if any, possess the prerequisites for growth and development: a suitable long-term supply of stumpage, adequate risk capital, technical know-how and business acumen.

Output

In the 11 years 1949 through 1959, lumber production increased from 46 million f.b.m. (1949-1950) to 60 million (1953-1954) and declined to 37 million (1958-1959), averaging 47.4 million f.b.m. for the period (Table 4-26). On the average, three-quarters of the lumber was cut from sawlogs originating on Crown lands, one-quarter from private lands.

From Table 4-27 it is apparent that Newfoundland's lumber production has continued to decline in the 1960's, averaging 33 million f.b.m. from 1960 to 1966, but only 26 million in 1966. This table also shows the distribution of lumber production by region and land tenure. The average production figures (1960-1964) of 9.8 million f.b.m. for the Eastern, 14.7 million f.b.m. for the Central, and 11.2 million f.b.m. for the Western Region, represent percentages of 27, 41 and 32 respectively. The corresponding percentages of sawmill numbers are 42, 25 and 33 (see Table 4-24). There is no inventory of sawtimber volumes available by region, but pulpwood percentages may be of the order of 15, 42 and 43 per cent, respectively. Relatively, then, this would indicate an over-emphasis of sawmilling in the east and an under-emphasis in the west, where sawlog supplies are more abundant. However, the existing land-tenure structure is a major obstacle to rectifying this imbalance.

1/ This is slightly at variance with the number of mills licensed in 1965 as reported by the Newfoundland Forest Service. See Tables 4-24 and 4-27.

TABLE 4-26

Lumber Production from Crown and Private Lands, Newfoundland, 1949-1959

Year	No. of Mills	Crown Lands	Private Lands	Total
	no.	-------	thousand f.b.m.	------
1949	-	27,975	18,286	46,261
1950	1,148	33,479	13,119	46,598
1951	-	32,736	16,350	49,086
1952	1,343	41,488	12,529	54,017
1953	-	49,016	12,696	61,712
1954	1,409	40,000	18,000	58,000
1955	1,419	34,500	8,500	43,000
1956	1,609	33,558	8,280	41,838
1957	1,631	39,790	7,115	46,905
1958	1,654	27,924	6,762	34,686
1959	1,591	27,271	12,103	39,374
Total	10,656	387,737	133,740	521,477
Average	1,522	35,249	12,158	47,407

Source: Newfoundland Forest Service.

TABLE 4-27

Lumber Production by Region and Land Ownership, Newfoundland, 1960-1966

Year	No. of Mills	East			Central			West			All		
		Crown	Private	Total	Crown	Private	Total	Crown	Private	Total	Crown	Private	Total
	no.	-------			-------	thousand	f. b. m.	-------					-------
1960	1,353	8,515	706	9,221	10,845	1,971	12,816	7,010	7,156	14,166	26,370	9,835	36,205
1961	1,352	9,069	844	9,913	11,077	3,337	14,414	6,042	7,922	13,964	26,189	12,103	38,292
1962	1,308	8,790	972	9,762	10,577	3,120	13,697	5,564	3,693	9,257	24,931	7,785	32,716
1963	1,456	10,209	1,847	12,056	12,667	4,011	16,678	6,044	4,720	10,764	28,920	10,577	39,497
1964	1,217	7,147	896	8,043	10,289	5,582	15,871	5,587	2,309	7,896	23,252	8,788	32,040
1965	1,128	-	-	-	-	-	-	-	-	-	18,094	7,277	25,371
1966	-	-	-	-	-	-	-	-	-	-	19,515	6,778	26,293
Total	7,814	43,730	5,265	48,995	55,455	18,021	73,476	30,247	25,800	56,047	167,271	63,143	230,414
Av.	1,302	8,746	1,053	9,799	11,091	3,604	14,695	6,049	5,160	11,209	23,896	9,020	32,916

Source: Newfoundland Forest Service.

Unalienated Crown lands contribute about three-quarters of the sawlog inputs (Table 4-28) yet comprise only about one-third of the productive forest area.

Types of lumber produced include board (34 per cent), scantling (56 per cent) and other (10 per cent), as shown in Table 4-29. The board output is mainly in small sizes.

TABLE 4-28

Percentage Sawlog Production by Land Ownership, Newfoundland, 1949-1965

Year	Source of Sawlogs	
	Crown Lands	Private Lands
	%	%
1949	60	40
1950	72	28
1951	67	33
1952	77	23
1953	80	20
1954	69	31
1955	80	20
1956	80	20
1957	85	15
1958	80	20
1959	69	31
1960	73	27
1961	68	32
1962	76	24
1963	73	27
1964	72	28
1965	72	28
1966	74	26
Average	74	26

Source: Newfoundland Forest Service.

Marketing

Most lumber used on the Island, especially in the larger urban centres, is imported, largely from New Brunswick and Nova Scotia. The Minister of Mines, Agriculture and Resources (1966) reported that some 22 million f.b.m. of lumber was imported in 1965. Assuming domestic production of 25 million in 1965 (Table 4-27), imports thus approximate 50 per cent of present consumption.

TABLE 4-29

Types of Sawmill Products, Newfoundland, 1960-1964

Year	Board	Scantling	Other
	%	%	%
1960	34	55	11
1961	37	53	10
1962	30	57	13
1963	29	60	11
1964	39	53	8
Average	34	56	10

Source: Newfoundland Forest Service.

In the words of the Minister (1966):

> "Prior to Confederation, Newfoundland sawmill operators were able to compete with imported products, even with inefficient milling practices. After Confederation, and the subsequent free exchange of goods between provinces, this situation changed. Newfoundland mills are small and inefficient and the logging methods practised by the sawmilling industry in Newfoundland are generally archaic and expensive. Consequently, lumber can be brought into Newfoundland at more than competitive prices."

As the result of a request of the Newfoundland government, the Maritime Lumber Bureau has maintained a branch office in Gander since 1965, conducting a grade-marking program for local lumber and providing training in grading. At present 12 sawmills are licensed to use the M.L.B. grade-marking. These mills process about 50 per cent of the total lumber production on the Island. It should be noted that the output of many smaller mills is channelled through the licensed mills. No large increase in the number of licensed mills is expected.

Reasons for the present imbalance between supply and demand of lumber and the observed decline in domestic production are manifold:

1) Imported lumber is available at lower prices.

2) Required volumes and grades can be delivered on schedule.

3) Although lumber grading has been introduced, much of the local product is poorly manufactured and ungraded.

4) The average local sawmill is small, the equipment obsolete and its operation inefficient.

5) Access to an appropriate sawlog supply is difficult and expensive.

6) Most logging operations are small in scale and inefficient.

7) Employees available for logging and sawmilling operations are seasonal and relatively unskilled.

8) Labour turnover is accentuated by relatively attractive welfare and unemployment benefits.

9) Sawmills are often dependent for their sawlog supplies upon numerous cutters who obtain their own cutting permits and produce sawlogs and pulpwood.

10) Neither the province nor the pulp and paper industry has adopted a forest-management policy which provides to the sawmill operator any assurance of a year-to-year sawlog supply, let alone a long-term supply.

11) The sawmill operator has no appropriate collateral with which to finance modernization or expansion of his manufacturing plant.

Industry Problems

The problems of the Newfoundland sawmilling industry have been the subject of growing concern. In 1963, a sawmill conference was convened by provincial government officials in order to pin-point the ailments of the industry and, ultimately, to provide guidelines for corrective measures. A committee was formed and charged with the task of making recommendations. These were submitted to the provincial government, but little or no action has been taken to date other than the construction of certain access roads.

As a part of the present study, during the summer of 1966 the operators of larger sawmills were circularized and asked to complete a questionnaire. In addition, a number of operators were interviewed personally. The following problems were pointed out, both in the replies to the questionnaire and in personal discussions:

Labour. Woods labour available for cutting sawlogs is scarce. Cutters reportedly can earn more cutting pulpwood than sawlogs. Woods work is still mainly seasonal; some workers prefer to draw welfare and unemployment benefits rather than work for short periods, or to work only until they are eligible for benefits. Consequently, the labour force available to sawmillers includes largely untrained, inefficient, casual labourers. Labour training in mechanical skills is an urgent need.

Sawlog Supply. An adequate supply of sawlogs is believed to exist, sufficient for present and, indeed, expanded sawmill capacity. The most promising method of ensuring an adequate supply is through integrated operations - that is, through simultaneous harvesting of all

merchantable wood, including both sawlogs and pulpwood. Some practices seem to be working in an opposite direction - for example, some logging operators reported that they were paid less per cord for pulpwood than contractors cutting only pulpwood on the same lands. There is also widespread apprehension among loggers that introduction of a third pulp mill will place in jeopardy the future sawlog supply of many sawmills in the eastern region. Lack of a clear-cut, well-publicized government policy with respect to future sawlog supplies from Crown lands is a cause of concern.

It is the feeling of the sawmill industry that the future for the lumber industry lies in guaranteeing a reasonably long-term supply of sawlogs to a small number of large-capacity, efficient, automated sawmills to be located in regional growth centres. Suitable raw-material for such mills, especially balsam fir, is available, though not readily accessible, particularly in western Newfoundland.

Technology. Equipment demonstrations and short courses on work-study methods would be helpful. Woods and sawmill operators require up-to-date information on current technology, new equipment, and training in business management.

Transportation. Although great advances have been made in constructing new all-weather roads and in the development of heavy-duty truck-transport equipment, with the objective of reducing unit delivery costs, highway load limits often prohibit the optimum use of this equipment, and old bridges and culverts place ceilings on load limits. The industry suggests the need for all-weather access roads on both Crown and private lands, in accordance with a master plan for a permanent transportation system to serve all provincial needs.

Small Trees. The generally small size of trees in Newfoundland restricts the efficiency of lumber production by present methods of utilization. This small-tree problem is becoming, in fact, of nation-wide importance as large, mature, virgin stands become depleted. It has given impetus to product research in the use of lamination and other economical methods of fabricating structures from lumber small in dimension and short in length. In Newfoundland the small-tree problem is of special significance, since this province experienced it earliest and in a particularly acute form.

Labrador Sawmills

The sawmilling industry in Labrador is virtually static; a few small mills produce an ungraded product for local consumption. Although the virgin forests contain a considerable quantity of sawtimber, much of it is controlled by various companies; there are only small areas of unalienated Crown forest land.

As it develops, the Churchill Falls Power Project will have an impact on Labrador's forest-based industry. This impact will be sharply reinforced if the fourth pulp mill starts operations on the Island. These developments will generate local demand for construction lumber and promote increased exploitation of Labrador's forests.

In Labrador, as on the Island, there is danger that potential sawlogs will be used for pulpwood and that, as a result, all lumber will have to be imported.

Other Forest Products

Other forest industries are represented by a few plants with a limited production. At Donovans, near St. John's, a particle-board plant produces pressboard for export and domestic markets. This plant consumes about 9,000 cords per year, with the supply coming from the Avalon region. Also, at Donovans, is a furniture factory. It uses some local birch but depends mainly on imported material. Production, which is 55 per cent ties, 30 per cent veneer, and 15 per cent lumber, is marketed locally. The same company operates a creosoting plant at Clarenville, Trinity North District, for treatment of railway ties, poles, posts and construction timbers. This plant treated a total of 930,000 board feet in 1964, and 5,000 poles. Since 1965, the poles have been shipped from Labrador.

These secondary industries are faced with a number of problems, including increasing competition from the mainland, an unfavourable freight-rate structure, the lack of an economic wood supply and, at times, prohibitive access costs. The wood-supply situation could become worse because of the potential requirements of the third and fourth pulp mills.

5. INSTITUTIONAL FACTORS

Taxation, Stumpage and Royalties

Under existing legislation, the forest-based industries in Newfoundland contribute but sparingly to provincial or municipal revenue. Under their agreements with the province, neither of the two pulp and paper companies pays stumpage or royalties on pulpwood used for manufacture in their own mills. Bowaters is required, however, to export at least 50,000 cords of pulpwood per year and pays an export levy of 30 cents per cord. Ground rent is levied at the rate of $2.00 per square mile of productive forest. Contributions in the order of $40,000 per year are made by the pulp and paper companies to the Newfoundland Forest Protection Association for protection on their own limits.

Sawmill licences cost $20 annually, whether a mill is small or large. Price (Nfld.) Ltd. pays 50 cents per thousand f.b.m. on lumber cut and sold from Crown lands. However, both of the pulp and paper companies are free to sell Crown-owned stumpage or sawlogs to sawmill operators.

Privately owned forest land is not subject to any tax, although a levy is charged for the export of unprocessed roundwood. No property taxes or school taxes are paid on any forest land.

Moore (1957) summarized the tax position of Bowaters as follows:

> "In addition to its other concessions, Bowaters was granted exemption from all taxes whatsoever in perpetuity except for a tax on income. For the period ending in 1973 the annual tax on income was not to exceed $150,000; thereafter no maximum is specified. At present no provincial profits tax is levied on either company. In the view of the provincial authorities, the agreement with Bowaters .... effectively precludes the province from obtaining any substantial revenue from operations of that company; and the inability to tax Bowaters implies, in the interest of fair treatment, abstention from taxing Price (Nfld.) Ltd."

The Kennedy Commission deplored the terms of these agreements.

Direct forest revenue to the province from various sources is summarized in Table 4-30 for the fiscal years 1962-63 to 1966-67.

TABLE 4-30

Direct Forest Revenue, Newfoundland and Labrador, 1962-63 to 1966-67

Fiscal Year	Sawmill Licences	Timber Rental	Timber Royalties	Cutting Permits	Total Revenue
	$	$	$	$	$
1962-63	27,014	31,367	80,465	7,594	146,440
1963-64	25,004	31,053	114,138	6,406	176,601
1964-65	26,702	31,046	138,429	5,451	201,628
1965-66	21,740	31,052	164,457	4,376	221,625
1966-67	21,330	31,083	129,442	4,468	186,323
Total	121,790	155,601	626,931	28,295	932,617
Average	24,358	31,120	125,386	5,659	186,533

Source: Newfoundland Forest Service.

6. CONCLUSIONS

Changes to the present agreements with the two pulp and paper companies are not only justifiable but essential to the further growth of Newfoundland's forest industry. The changes need not affect the companies adversely. The companies have been in a preferred, indeed envied, position in the pulp and paper industry for many years by having available a supply of wood free of stumpage, royalties or other direct taxes or charges; payment of equitable charges now will not exert undue hardship.

The benefits to be derived are many. The primary benefit would be to the economy of the province as a whole, since the receipt of revenue from this source is, at present, closed to the government. Assuming a stumpage charge of $2.00 per cord of pulpwood, a relatively low charge, the 1965 production of 990,000 cords would have yielded almost $2,000,000 to the province, in contrast to the $200,000 actually received from existing forest charges.

By assuming greater authority over the Crown lands under licence, the government would be able to initiate sound forest management. Whether management is practised by the companies under government supervision or whether the government itself undertakes to implement a management plan is of far less importance than that planned management be inaugurated. The present stipulation that the companies shall "carry out cutting operations in accordance with good logging practice" is incapable of enforcement. The companies freely admit that forest management is not now being practised; one company forester stated that forest-management expense is not justified at present. A well-conceived plan will identify areas of high potential productive capacity, where sylvicultural treatment can yield substantial monetary returns, and will provide for the rapid re-establishment, after cutting, of a forest crop of desired composition. Since the allowable annual cut is generally greater for a managed forest than for an unmanaged one, it is probable that the current allowable annual cut would be increased appreciably.

If action were taken to revest the licensed lands in the Crown, the Crown would then become responsible for all fire protection activities in the province. Currently, each company maintains its own protection force, while the government provides protection on Crown lands. Though co-operation in the past has been excellent, greater efficiency and assurance of effective action in emergencies would be provided by a single fire-fighting force.

With better control over the forest production of the province, the government would be able to seek out additional forest industries, preferably those able to utilize species not now being used or using material which is considered to be waste. For example, the Kennedy Commission estimated the volume of white birch on the Island in 1954 to be over 3 million cords; little of this is currently being utilized.

A final benefit, predicated on better provincial control of the forest resource, would accrue from the opportunity to utilize more efficiently the sawlog material which is now being converted into pulpwood.

Sawmilling is declining steadily in Newfoundland. Output dropped from 45.3 million f.b.m. in 1950 to 13.1 million f.b.m. in 1965, at a rate of 3.6 per cent per year over the period. The rate of decline accelerated during the more recent years - loss of output between 1960 and 1965 was at the rate of 8.9 per cent per year. In 1955 production in Newfoundland sawmills was about equal to estimated local consumption, but by 1965 production had dropped to about 22 per cent of estimated provincial consumption. There is no reason to expect that the industry as now constituted will do other than continue to decline. Its only hope would seem to be in the direction of integrated operations in association with the pulp and paper industry. As part of an integrated operation, sawmills would have access to the larger sawlogs on pulp and paper company limits, and the pulp mills would provide a market for the chips that would form a major byproduct of a large-scale, technologically efficient sawmilling operation. Sawmills can only be assured of a continuing place in the Newfoundland economy as an adjunct to, and a part of, the movement of wood from the limits of the pulp and paper companies to the mills.

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FORESTRY
in the
ATLANTIC PROVINCES

PART FIVE

PRINCE EDWARD ISLAND

PART FIVE
CONTENTS

PART FIVE
TABLES

FORESTRY IN THE ATLANTIC PROVINCES

PART FIVE: PRINCE EDWARD ISLAND

1. NATURE AND DISTRIBUTION OF RESOURCE BASE

Prince Edward Island lies from 10 to 30 miles off the east coast of New Brunswick and Nova Scotia in the Gulf of St. Lawrence. Winds from the north, north-east, east, south-east, and south pass over long sweeps of open sea and build up high velocities before hitting the shores of Prince Edward Island. In addition, the prevailing wind (north-west in winter and south-west in summer) blows over a considerable distance of open water before encountering the Island's shore. As a consequence, these coast lines tend to exhibit the effect of prolonged exposure to high winds and salt spray. This results in deformed trees and reduced height growth and volume in stands adjacent to exposed shores. The resultant reduction in growth varies with the measure of protection offered by topography and by windbreaks such as other stands of trees growing closer to the coast. However, the whole Island suffers to some degree from this effect.

Periodically the western part of the Island, especially the western two-thirds of Prince County, suffers a sleet storm with consequent damage to tree tops.

Certain coarse-textured soils were found to be underlain by an impervious layer at about a three-foot depth, well within the rooting zone of trees. Such soils, though droughty for agricultural purposes, were found to be the equal of the best agricultural soils when rated for timber production. These soils include the Culloden and, to a lesser degree, the Dunstaffnage series in Kings and eastern Queens Counties, and the Culloden and Kildare (where not exposed to sea winds) in western Prince County.

Present forest cover does not necessarily represent the climax forest which the area would support if left undisturbed. This is because most of the Island has been cleared for agriculture since man began settling it. Only a few very wet areas escaped the axe. A considerable portion of the cleared land was later abandoned and has reverted to forest cover, principally white spruce. On some sites this species is not necessarily the most desirable with respect to productivity or quality. For example, on the droughty Culloden soils of Kings County it is highly probable that - both in volume and value - the yield would be considerably higher for pine than for spruce.

Land Capability Classes

Land capability inventory for forestry was completed by the Atlantic Forestry Institute in September, 1966, and is now (1968) being processed by ARDA in Ottawa. Once this has been completed, maps can be prepared classifying land by forest productivity classes for the Island as a whole. All land will be included regardless of present land use.

The distribution of acreage by land use is presented in Table 5-1.

TABLE 5-1

Major Land Use Categories, Prince Edward Island, 1959

Land Use Class	Area	
	acres	%
Agriculture	754,720	54.0
Cropland	504,950	36.1
Improved Pasture	149,180	10.7
Abandoned Grassland	100,590	7.2
Woodland	594,560	42.6
Other (bogs, beaches)	36,770	2.7
Urban	9,710	0.7
Total	1,395,760	100.0

Source: Land utilization in Prince Edward Island, Department of Mines and Technical Surveys, Geographical Branch, Memoir 9, 1963.

Table 5-1 reveals that, although cropland and improved pasture occupy 46.8 per cent of the Island's land area and the addition of abandoned grassland raises the total agricultural acreage to 54 per cent, woodlands account for 42.6 per cent of land area.

Areas which have a high capability rating for agriculture, of course, also have a high potential for forestry. The decision as to which use should be dominant is an economic one. However, there are areas of high capability which, because of the degree of slope, might better be retained in timber to prevent erosion. On such areas cost-benefit studies may be needed to determine whether grass or tree-cover would be most desirable.

The forest area classification is presented in Table 5-2.

Relative to the other three Atlantic Provinces, Prince Edward Island has a much smaller proportion of forest land bearing merchantable timber.

TABLE 5-2

Forest Area Classification, Prince Edward Island and Other Atlantic Provinces, 1962

Classification	Prince Edward Island		Other Atlantic Provinces	
	000 acres	%	000 acres	%
Productive forest land:				
Merchantable	143	24	34,387	42
Young growth	353	59	8,655	11
Unclassified	24	4	3,569	4
Total productive forest land	520	87	46,611	57
Non-productive forest land	78	13	35,562	43
Total forest land	598	100	82,173	100

Source: Canadian Forestry Statistics, 1962. D.B.S.

Estimated Wood Volume

The 1966 forest inventory by Acres Research and Planning Ltd. indicated a total merchantable wood volume of 1.7 million cords (148 million cubic feet). D.B.S. estimated a similar volume in 1959, but substantially more in 1963 (250 million cubic feet). Acres and D.B.S. also differed in their estimates of distribution by species. (See Table 5-3.)

The 1966 forest inventory divided the Island into three geographical blocks, which correspond roughly to the political subdivisions of Prince, Queens and Kings Counties (Blocks I, II and III, respectively, in Table 5-4).

Growth, Loss and Stability

Little information is available on annual growth rates on the Island. The 1965 inventory indicates, on selected plots in Kings County, growth rates of 0.4 to 0.8 cord per acre per year in spruce stands. A growth study in Queens County (Bailey, 1964) indicated mean annual increments in merchantable volume in spruce stands from 0.25 to 0.75 cord per acre. The mean annual increment for cedar was estimated to be 6 cubic feet per acre.

Natural restocking of abandoned farm lands is such that overstocking, rather than understocking, is a problem. In several localities a history of repeated burns may have created an area in which tree stocking is negligible, but these are neither extensive nor numerous. Cut-over areas, on the whole, appear to be regenerating adequately, and the amount

TABLE 5-3

Distribution of Merchantable Timber Volume, Prince Edward Island, by Species

Species	Merchantable Volume Estimates	
	D.B.S.1/	Acres Research2/
	%	%
Spruce	38	39
Balsam fir	24	18
Other softwoods	5	5
Maple	16	21
White birch	10	12
Other hardwoods	7	5
Total	100	100

1/ Canadian Forestry Statistics, 1962. D.B.S.
2/ Development Planning for P.E.I.; Woodlot Inventory, Acres Research and Planning Ltd., 1967.

TABLE 5-4

Geographic Distribution of Sawlogs and Pulpwood Timber, Prince Edward Island, 1965

Block	Merchantable Timber		
	Total	Sawlog	Pulpwood
	cords	000 f.b.m.	cords
I	211,954	-	211,954
II	287,375	5,290	269,150
III	1,239,851	70,225	1,064,289
Total	1,739,180	75,515	1,545,393

Source: Acres Research and Planning Ltd., 1967.

of understocked or "fail" area observed was extremely small and, indeed, insignificant. However, it should be noted that a major component of natural regeneration on cut-over land is balsam fir (in contrast to white spruce on abandoned farm land). Balsam fir is generally considered to be an undesirable tree species on Prince Edward Island. Its growth is inhibited by infestations of the balsam woolly aphid, its relatively brash wood renders balsam fir trees susceptible to snow, ice and wind damage, and the wood is most suitable for low-value end uses, such as pulpwood. Some wood-

lots were found to be grazed by cattle; where this occurred the woodland generally was in a poor condition, both in number of stems and in quality of individual trees.

Disease and insect damage is not of epidemic proportion anywhere on the Island. However, should any large-scale stand conversion or planting program be adopted, certain insects and diseases may cause problems. Pine stands may be particularly vulnerable. Red pine plantations have shown signs of damage from weevil and from shoot moth, while blister rust is evident on many of the white pine trees and reproduction.

Forest fires are a problem only during dry years and then only on a local scale. The network of roads and the intermixture of field and forest renders the individual blocks of timber small and accessible. In the vicinity of several pockets of marginal farm land there are areas in which wildfires periodically occur. This is a social rather than a physical or biological problem, requiring programs of education and economic development.

In addition to the effect of wind on tree growth previously discussed, there is a second consideration with respect to wind. Wind limits the kinds of forest husbandry that can be carried on. One may open up the forest crown to stimulate growth of individual trees and to encourage regeneration only with the knowledge that, if the crown is opened up too much, windthrow will surely occur.

On the average, once in about every ten to fifteen years the western part of Prince Edward Island is struck by a sleet storm which breaks off the crown or large side branches, thereby reducing growth, favouring entry of insects or disease, and damaging the form of the bole of the tree. There is little that can be done to eliminate or reduce damage resulting from this climatic phenomenon.

According to Loucks (1962) the western section of the Island, together with a narrow strip along the north shore, has as climax species red spruce, eastern hemlock and pine, while the major portion of the eastern half, in the absence of disturbance, would grow sugar maple, hemlock and pine. On the droughty Culloden soils, however, the pioneer association of white or red pine has great potential for the production of sawlogs.

Sustained Annual Yield Potential

Lack of information makes hazardous any estimate of sustained annual yield potential. A rough but reasonable estimate is a potential yield of 0.5 cord per acre per year. Applying this to the 367,000 acres at present considered as dense woodland, the potential yield would be estimated at 15 million cubic feet per year under appropriate management. Current utilization is about 10 million cubic feet annually.

2. TENURE

Since the amount of woodland, other than parkland, owned by the province is extremely small, there are no leaseholds on Prince Edward Island. Only about 4,000 acres, in widely scattered parcels ranging from about 10 to 700 acres, are owned by the Crown. They are managed by the Provincial Forester. The bulk of the woodland is privately owned, mainly in small woodlots associated with farms. Some acreage is in larger blocks which were originally cleared for agriculture, but were later abandoned and now support forest cover; some lies in wet areas unsuited to agriculture.

The 4,000 acres of forest land (other than parks) in Crown ownership is land which has been purchased by the Crown because it is not suitable for current agricultural use. Often it is abandoned farm land with little or no timber value present. No inventory has been made of these holdings, nor has any estimate been made of their potential growth. The only cutting carried out has been as a stand-improvement measure.

The balance of the Island's present forest capital is held in a large number of small ownerships. Many of the owners are farmers who regard their woodlots merely as sources of fuelwood or other farm-forest products. Another group is comprised of non-resident owners, people who have abandoned farming but retain ownership of the land. There has been no survey of the amount of land held by sawmills or pulpwood brokers. However, the Provincial Forester does not believe that such holdings form a significant portion of the Island's woodlots.

Impact of Scale and Absentee Ownership on Management Practices

According to the Provincial Forester, whose main activity is extension work, woodlot owners practise little forest management. Cutting is based upon a need for money, in which case the woodlot is usually sold on a lump-sum basis (and the contractor left free to cut as he sees fit), or upon a need for lumber, in which case the owner cuts the logs needed and has them custom-sawn in a nearby sawmill. Seldom is cutting based upon the need of the forest; i.e., to provide maximum growth of high-quality timber.

Absentee ownership is becoming common in certain parts of the Island, particularly on the droughty Culloden soils in Kings and eastern Queens Counties. The lands are being abandoned for agricultural use and are being allowed to revert to a forest condition. However, these lands usually restock very densely, and if left in this condition, tend to stagnate, with attendant loss of production. While most of the regeneration is spruce or fir, some hardwood regeneration occurs - particularly wire birch - which tends to be badly deformed and of limited value even for fuelwood.

Determination of Land Ownership

Land ownership and survey boundaries often prove difficult to determine. Many of the old survey lines have become obliterated with the passage of time. Also, the title-recording system is sometimes faulty in operation and changes of title are often difficult to trace. As a result, trespass - intentional or otherwise - frequently occurs.

3. WOODS OPERATIONS AND TRANSPORT

Although woods operations and transport in the Atlantic Provinces are described in an earlier part of this report, the situation in Prince Edward Island is sufficiently different to require special comment.

Harvesting Practices

Because nearly all individual forest holdings are small and provide only secondary sources of income for their owners, logging practice on the Island is relatively unsophisticated. Methods of harvesting are geared largely to the farm equipment available to the owner, whether horse- or machine-powered. Only a few operators have such specialized equipment as tree farmers, self-loading trucks or crawler tractors.

Given the existing land-ownership pattern, present practices are likely to change slowly, if at all. If a program of land consolidation were adopted in order to bring under single management large blocks of woodland and abandoned farm land, the introduction of specialized harvesting and transportation equipment might prove feasible.

Transport and Access

Wood moves from woods to sawmills either by truck or tractor-drawn wagon on provincial roads. No delivery is made by water or rail. There is an adequate network of gravel or paved roads on the Island, and extraction roads seldom exceed 1.5 to 2.0 miles in length. Grades are no problem, but soil conditions may be, particularly in the heavy clayloams of Prince County and the organic soils of the Armadale series in all three Counties. The movement of forest products does not require any substantial additions to the permanent network of roads.

There are no extensive areas of merchantable forest which are inaccessible, although building roads to extract timber from some small isolated blocks may be uneconomic.

Access for fire protection is generally good - most forested areas are within one mile of a road over which a four-wheel-drive tank truck can be driven most of the fire season. Some additional forest access roads should be developed, particularly in the heavier clay soils of Prince County. These would permit access to certain critical areas in the spring break-up period.

Woods Labour Force

Logging on Prince Edward Island is a highly seasonal occupation and, as a result, there is no group of truly professional woodsmen. If the farmer cannot handle a cut by himself, he contracts it to a jobber or hires his own crew, often neighbours. Fishermen have found winter logging operations a welcome source of additional income.

Woodsmen on the Island are not organized and their number is extremely difficult to estimate. The work period is also hard to define because of the seasonal character of the employment. Logging fits in when normal employment is at a low ebb and there is idle time. There is no organized training program for woods workers.

Because of the seasonal nature of the work, and the large number of small operations going on in widely scattered areas, it is extremely difficult to determine the economics of this industry. No studies of productivity, training requirements or pay scales have been undertaken.

Volume and Value of Output

For the 25 years prior to 1962, primary forest production has been close to 10 million cubic feet annually. In 1962, production dropped to 6 million cubic feet. It maintained that level through 1964, the last year for which figures are available. The roadside values have increased in conformance with the trend of wood prices in the other Atlantic Provinces. The total value of the Island's primary forest products has varied yearly between $1 and $2 million. Estimates for the years 1960 through 1964 are presented in Table 5-5.

TABLE 5-5

Estimates of Forest Production and Value, Prince Edward Island, 1960-1964

Year	Volume	Value
	million cu. ft.	million $
1960	10.8	1.5
1961	10.2	1.6
1962	5.5	0.9
1963	6.0	1.0
1964	6.1	1.0

Source: Logging, 1964. D.B.S.

In Table 5-6 the utilization of provincial forest products is presented in an effort to discern possible trends. Note that half of the annual cut is still used for fuelwood. Reduction of output following 1961 was mainly due to a sharp reduction in the cut of wood for fuel.

TABLE 5-6

Forest Production, Selected Years,
Prince Edward Island

Year	Logs & Bolts	Pulpwood	Fuelwood	Other	Total
	million cubic feet				
1940	1.1	0.2	10.2	0.4	11.9
1945	2.0	-	8.9	0.3	12.2
1950	2.7	0.7	6.2	0.3	9.9
1955	1.8	3.9	5.1	0.5	11.3
1960	1.8	3.7	5.2	0.1	10.8
1961	2.0	2.2	5.8	0.2	10.2
1962	1.4	1.7	2.4	-	5.5
1963	1.2	2.4	2.4	0.1	6.0
1964	1.3	1.9	2.8	0.1	6.1

Source: Logging, 1964. D.B.S.

4. PULPWOOD AND LUMBER

There are no pulp or paper mills within the province and, because of a shortage of fresh water in adequate amounts for pulping or paper-making, it is unlikely that there will be any such developments in the immediate future.

Pulpwood moves off the Island by ship (Georgetown and Summerside) and by truck (via Borden ferry). Mills in Nova Scotia and New Brunswick are logical markets for small-sized logs and chipped waste from sawmilling, but this market is not yet fully developed. About 90 per cent of pulpwood shipments goes into overseas exports; only about 10 per cent to the mainland.

Development of an integrated lumber and pulpwood chip operation would seem to offer the best potential for maximum utilization of the wood resources of the Island. The manufacture of lumber, therefore, holds the greatest potential for immediate development.

At present the Island supports about 62 sawmills. Only one mill has a drykiln and none a dressing plant. The quality of output is such that most contractors tend to favour Nova Scotia or New Brunswick lumber over that of the Island. Output is very small. Most sawmills produce less than 100,000 board feet of lumber annually. During two recent years, 20 mills went out of production. Table 5-7 gives an indication of the size of sawmills and shows their location by county.

TABLE 5-7

Prince Edward Island Sawmills, by Production Class and County, 1965

Annual Production	Number and Location of Sawmills			
	Kings	Queens	Prince	Province
f.b.m.	no.	no.	no.	no.
Under 100,000	14	8	13	35
100,001 - 250,000	5	6	4	15
250,001 - 500,000	2	4	3	9
500,000 plus	-	3	-	3
Total	21	21	20	62

Source: Company returns, 1966.

Because most mills are without cover, production is often dictated by the weather. Capacity must, out of necessity, be much larger than actual production. A common complaint is the lack of an adequate supply

of sawlogs.

The total sawlog cut in the province in 1964 was 8.93 million f.b.m., of which only 458,000 board feet was hardwood. (See Table 5-8.)

TABLE 5-8

Sawlog Cut in Prince Edward Island by County, 1964

County	Sawlog Cut
	f.b.m.
Kings	3,378,500
Queens	2,672,500
Prince	2,879,300
Total	8,930,300

Source: Acres Research and Planning, Ltd., 1967.

Spruce and fir were the main softwood species cut, with pine and cedar forming only a very small part. Maple, elm and birch were the principal hardwoods cut.

Most mills produce only lumber. Some, however, manufacture laths, shingles or shooks as well. Table 5-9 presents production by counties.

TABLE 5-9

Wood Products Production by Counties, Prince Edward Island, 1965

A. Lumber

County	Softwood	Mills	Hardwood	Mills
	thousand f.b.m.	no.	thousand f.b.m.	no.
Kings	2,290	21	114	13
Queens	5,232	21	154	14
Prince	2,355	20	48	14
Total	9,877	62	316	41

B. Lath, Shooks and Shingles

County	Lath	Mills	Shooks	Mills	Shingles	Mills
	thousand	no.	no.	no.	squares	no.
Kings	1,043	14	5,200	2	880	7
Queens	320	4	82,000	4	300	1
Prince	822	6	20,500	6	360	2
Total	2,185	24	107,700	12	1,540	10

Source: P.E.I. Department of Agriculture.

5. INSTITUTIONAL FACTORS

Taxation

The province levies no taxes on forest land. Local school districts levy taxes on all land, but forest land is taxed at a lower level than farm land.

Because the amount of Crown land is very small and little of what there is has supported logging operations, each Crown land sale is handled on a bid basis.

Forestry Extension

Within the limits placed on him in terms of time and money, the Provincial Forester attempts to inform woodlot owners, woods operators, and sawmill owners concerning new developments in forest practice and forest utilization. Until recently, when a second forester was added, the Provincial Forester was the only professional working in forestry on the Island. Although his main role is extension, he has a small nursery which provides planting stock for use on private and Crown lands. Money for the development and operation of this nursery was obtained through the Federal-Provincial Forestry Agreement of 1952, subsequently amended and extended.

6. CONCLUSIONS

Although Prince Edward Island may not be expected to become the site of a large forest-products manufacturing industry, the opportunity exists to increase the volume and value of production of sawlogs, pulpwood and other cash crops from woodlots and forests. Problems to be overcome include natural hazards, production and marketing inefficiencies, a relatively untrained woods labour force and the need for better forest management on freehold land.

Principal natural hazards are exposure to wind and periodic sleet damage. In other locations, wind damage has been reduced through the planting of windbreaks composed of long-lived trees to windward of commercial woodlands. Sleet damage is a more difficult problem, but some species and strains may be more resistant: their identification and use for planting, especially in Prince County, could help reduce future losses.

Certain soils of the Culloden, Dunstaffnage and Kildare series are relatively unsuitable for agriculture but rate high in their potential for forest cover. They should be considered for planting sites.

One of the most serious problems is the absence of progressive forest-management practices on freehold land. The extreme fragmentation of forest holdings and the generally small scale of harvesting operations are not conducive to good forest management. Only if means are found to overcome this problem can the production of forest products be expected to increase.

Training of woods workers and woodlot operators is a basic requirement if forest management and marketing are to be improved.

More effective use could be made of the wood available for harvest if lumber manufacturing could be concentrated in two or three well-equipped, efficiently-operated and strategically-located sawmills, and if export of pulpwood and sawmill residue (in the form of pulpwood chips) were co-ördinated by a single co-operative or other agency.

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FORESTRY
in the
ATLANTIC PROVINCES

APPENDIX

FORESTRY RESEARCH

A. MARITIMES
B. NEWFOUNDLAND

APPENDIX A

FORESTRY RESEARCH IN THE MARITIMES

According to the findings of the National Forestry Conference at Montebello in February 1966, the demand for Canadian forest products will increase fivefold by the year 2000. Canada will pass from an era of wood surplus to one of wood scarcity. This scarcity will probably first become evident in the Maritimes. The emphasis in research therefore should be aimed primarily at gaining knowledge leading to increases in productivity, whether by reducing current losses or increasing the growth of the forests.

This report attempts to give an outline of the current forestry research in the Maritimes. It deals primarily with the program of the Department of Forestry and Rural Development, but - where the information has been available - it includes programs of the provinces, universities and industry. Federal research depends largely on the help and collaboration of the other agencies, and, although this may not be explicitly stated in the following sections, it should be borne in mind.

The discussion is problem- rather than discipline-oriented because it is desirable that the contribution of different disciplines towards solving important problems be apparent. Topics such as economics, logging, mensuration, etc., which do not lend themselves to this approach, are discussed separately.

LAND CLASSIFICATION

Some knowledge of the classification of the land and its relative productivity for different purposes is essential to intelligent land management. The Forestry Branch has already produced a general classification of the forests of the Maritimes. ARDA is currently financing the Canada Land Inventory, a joint survey with the provinces of land capability for use in agriculture, recreation, wildlife, and forestry. The Federal Forestry Branch is collaborating with the provincial forest services of New Brunswick and Nova Scotia in making the survey for forestry use. The Atlantic Forestry Institute had a contract for the Prince Edward Island survey.

Briefly, the forest land is being classified in seven capability classes and mapped on aerial mosaics to the scale of about 15 chains to the inch. The data from these mosaics are transferred to maps at the scale of 1:50,000 and the data on these will be the basis for

published maps at the scale of 1:250,000. A unique system has been devised for recording all the basic data on magnetic tape for convenience of retrieval. It should be possible to draw a line around any given area on the key maps and have a computer deliver all the recorded information for that specific piece of land.

Federal staff have been collecting most of the field data. Recently, however, agreement was reached for New Brunswick and Nova Scotia to take over this responsibility and for the federal role to become one of providing technical advice and co-ordination. Originally, the survey was scheduled for completion in 1969. Prince Edward Island has been completed, but the survey in the other provinces will probably take until 1970 owing to difficulty in getting trained staff.

The program has been criticized because the maps that will be its end product will be suitable only for policy decisions and of little utility to the local land manager. It seems likely, however, that the finished product will (as with the provincial forest inventories) prove to be the source of basic information that will be put to uses not yet thought of. For example, the maps will provide the only objective estimates of the potential productivity of the forest land of the Maritimes and its relative worth for alternate land use. In view of the decisions that will have to be made about the allowable expansion of the forest industries, the value of this information is obvious.

Although spanning the entire Maritimes, the Canada Land Inventory was originally scheduled to include only those areas in the fringe between dominant agricultural and forestry use. Consideration has been given to a proposal to extend the Canada Land Inventory into a Wildland Survey to cover all the forest land capable of supporting merchantable forest. If implemented, this program is expected to take 10 years, with much of the first five years being devoted to research on techniques and devising a suitable system of classification. The work would be done by teams of pedologists, geomorphologists, ecologists, wildlife specialists, etc., working together. The aim would be to give an integrated picture of the physical resources of the land that would be a basic guide for the land-use planners and managers, taxation authorities, etc.

In the Maritimes, this would mean much more detailed classification of specific regions. It would necessitate much more research on the correlation between vegetation and features of the habitat, and application of this information to the prediction of productivity and appropriate land-use practice.

MANAGEMENT OF SPRUCE AND FIR

Most of the forestry research in the Maritimes has been related in one way or another to the management of spruce and fir. For convenience, the problem will be discussed under the general headings of sylviculture and protection.

SYLVICULTURE

Organizing the information under this heading is difficult. Much has been done on traditional techniques such as cleaning, thinning, conversion of mixed and hardwood stands to conifers, regeneration cuttings, sylvicide treatments, etc., by many private and government organizations. These run the gamut from formal experiments to ad hoc one-shot trials, and saying just where research proper ends and progressive management begins is difficult. New Brunswick International Paper Company, for example, has had an experiment station at Causapscal for many years. During the last few years, the J.D. Irving Company has been making extensive trials of stand conversion and sylvicide applications. Fraser Cos. Ltd., have collaborated extensively with the Forestry Branch. The New Brunswick Department of Natural Resources is continually making trials of harvest cutting and cultural treatments to get natural regeneration. The Nova Scotia Department of Lands and Forests has a Sylvicultural Section whose function is to develop appropriate sylviculture for the management of Crown lands. Many other examples could be mentioned.

Sylvicultural trials of an extensive nature are urgently needed to translate the results of more formal experimentation into general management practice. However, discussion here will be limited largely to the more formal experimentation. For convenience, it will begin with young to middle-aged stands and the research aimed at increasing their productivity.

Density, Cleanings and Thinnings

The Maritimes have large areas of young to middle-aged spruce and fir with very high stocking. This is owing partly to the ease with which advance growth establishes itself on many Maritime sites and partly to the effect of budworm infestations on the structure of the forests. Since these stands will provide most of the softwood during the next 50 years, their management is a major problem, and the normal impulse is to reduce their density by cleanings and thinnings.

As a rule, the yield of fibre of a given site cannot be increased by any method of thinning, but its distribution on individual stems, the size of the final crop trees, the length of rotation, and the cost of harvesting the crop are all very materially influenced by stand density and size and spacing of trees. For this reason, vast efforts have been devoted to studies of stand density and thinning. Until recently, however, most of such work in the Maritimes has been on a hit-or-miss basis, with little thought to synthesis or to understanding the physico-ecological basis of tree growth. Unless this is understood, one has to go through the laborious, time-consuming procedure of establishing many thinning experiments all over the region.

Within the past few years a different approach has been taken. Comprehensive studies of the influence of density on fir and spruce have been started at Green River in northwestern New Brunswick. These encompass stands varying widely in age and density. Detailed data have been taken on more than 11,000 stems; for some trees the weight of foliage, branches,

stem wood, stem bark and roots have been determined. To complement these data, studies of the efficiency of photosynthesis (the physiological basis of productivity) are being made of the various kinds and ages of leaves and of the tree crown as a whole. The physiological controls of tree growth are also being investigated.

It is hoped these studies will yield information on the total potential yield of the sites, and the best ways of manipulating density to produce optimum yields in terms of tree size and volume for different objectives. They are also aimed at getting basic data for branch wood, etc., needed for estimating volumes of slash and bark, etc., that have to be disposed of in full-tree logging and also needed for estimating nutrient drain on the sites. Finally, they may permit the devising of computer models to predict stand development under any given regime of treatment, and eliminate much guesswork and unnecessary replication in experimentation elsewhere in the Maritimes.

Supplementary, but less intensive, studies of spacing have been in progress in natural stands in central New Brunswick for 20 to 30 years. Several more experiments have been started in young stands in central Nova Scotia and Cape Breton within the past two years. More are planned for all three provinces and these will be supplemented by long-term planted experiments.

Regardless of the effect of treatment on growth, two other closely related problems have to be solved before cleaning and thinning are likely to become normal management practice, namely, how the physical work is to be done and its economic justification. These treatments are labour-intensive and expensive. Woods labour is scarce and, in 1966 the Nova Scotia Sylviculture Section's costs for cleaning and thinning averaged $47 and $57 per acre, respectively.

It is reported that reasonable rates of production have been achieved in Scandinavia by trained teams using brushmasters in stands with trees up to 2" d.b.h. It seems probable, however, that machinery will have to be developed for cleaning and thinning before the practices become common in Canada.

Fertilization

Fertilization has considerable potential, not only for increasing the growth rate of stands approaching maturity, but for breaking stagnation in very dense, pole-sized stands and in the afforestation of difficult sites. It has the additional advantage of requiring a relatively small labour input. Both industry and provincial governments are interested in the possibilities of fertilization, and this interest has been greatly stimulated by the example of the Swedish Cellulose Company, which in 1966 treated 150,000 acres with 15,000 tons of urea at a cost of $1.7 million (U.S.). Dr. H. Krause of the University of New Brunswick, described the applicability of the technique as follows:

> "Whereas in most other cases, fertilizer use served to correct severe nutrient deficiencies and constituted a

form of soil amelioration and a long-term investment, the Swedish pattern gives preference to stands in which nutritional conditions are not too far removed from the optimum. Such stands may be expected to have a well-developed system of feeding roots and a satisfactorily functioning photosynthetic apparatus. Thus, rather than first repairing a system deteriorated from chronic malnutrition of phosphorus and potassium, and perhaps also magnesium, investments are made in well-functioning, fibre-producing systems which are capable of putting to immediate use for wood production additional nitrogen.

"Although there may be cases in New Brunswick where severe nutrient deficiencies prevent satisfactory growth during the early age of plantations and natural stands, treatment of middle-aged and near-mature stands according to the Swedish pattern would appear to be the more attractive form of fertilizer use at the present time.

"Can the Swedish findings, provided they are correct and need no further confirmation, be applied to New Brunswick conditions? Certain similarities in climate may favour a positive decision. Possible differences between soils, however, should warn us from making broad generalizations.

"The majority of soils in Sweden are derived from glacial drift of granitic origin. Soil-forming materials belonging to this type usually contain fair amounts of primary silicates, such as feldspars, micas, and an admixture of ferro-magnesian minerals, which serve as slow but continuous sources of potassium, calcium and magnesium in forest soils. Granitic materials usually also carry some apatite in the finer fraction. This mineral serves as the original source of phosphorus.

"In large portions of New Brunswick, soils are derived from till which has not originated from igneous rocks but from sedimentary rocks. If not calcareous, these consist mainly of quartz and secondary clay minerals, both of no or low nutrient value. Such materials, if not mixed with igneous rock fragments while having been transported by the ice, give rise to soils of low fertility. It is possible, therefore, that in many soils of New Brunswick not only nitrogen but also phosphorus and potassium, or perhaps even magnesium are limiting factors in tree growth. Where this is the case, nitrogen treatments alone, according to the Swedish system, would remain largely ineffective.

"Some information on the nutrient-supplying power of forest soils may be obtained from foliar and soil analysis. However, at the present stage of development, such information does not indicate whether or not a response to fertilizer treatment can be obtained, nor can it be used to determine

optimum fertilizer combinations and rates of application. In order to obtain reliable information, it will be necessary to start forest fertilization work in New Brunswick with field experiments."

With slight modification, Dr. Krause's comments are also appropriate for Prince Edward Island and Nova Scotia.

During the past two or three years, the Nova Scotia Sylviculture Section has made preliminary trials both with air application on forest stands and with ground application in young plantations. In 1966, for example, it fertilized 300 acres of forest with 150 lbs./A of N at an average cost of $20 per acre. Most of the trials have been designed to test operational techniques and equipment, but some ancillary work has been done with foliar diagnosis to determine actual nutritional needs of red spruce.

The J.D. Irving Company has fertilized several hundred acres by plane. The Forestry Branch, the Pulp and Paper Research Institute of Canada, and Bowaters-Mersey Paper Company collaborated in 1966 in a small, replicated experiment in southwestern Nova Scotia. The New Brunswick Department of Natural Resources undertook some experiments in 1967. So far, no results are available from the trials made.

Trials of this sort should be encouraged, but they are no substitute for carefully designed ground experiments aimed at yielding response curves for the major nutrients. A series of such experiments covering a wide range of soils is needed to provide a sound basis for the practical use of fertilizers. These should be supplemented by fundamental studies of nutrient circulation and the nutrient requirements of trees, and by cost-benefit studies of pilot-scale trials.

So far, because of a lack of competent investigators, none of this has been done. The situation is improving. Both the Forestry Branch and the University of New Brunswick Faculty of Forestry have added soils chemists to their staffs. The Forestry Branch is assisting Prof. Krause in establishing six factorial experiments at different locations in New Brunswick involving two levels of nitrogen, phosphorus and potassium. Prof. Krause also expects to get a grant from the National Research Council to start a study of N circulation. The Forestry Branch has initiated a study of nitrification in forest soils and plans on establishing field experiments comparable to Prof. Krause's in collaboration with the Nova Scotia Department of Lands and Forests. Efforts are also being made to recruit a scientist to work on tree nutrition and techniques for diagnosing nutrient deficiencies.

Stand Development and Growth and Yield

Information has always been desired on the growth and merchantable yield of Maritime forests, both for policy decisions on the expansion of industry and for forest-management planning on both a local and regional scale. Where appropriately used, empirical and normal yield tables can be very useful, and thousands of plots have been and are being established

by federal, provincial and private agencies for inventory purposes, growth prediction, and observation of ecological trends in stand composition and structure.

Nova Scotia has used normal yield tables to advantage in making inventories and in determining the financially appropriate level of management for land of different site quality. Unfortunately, normal yield tables are designed primarily for use with even-aged stands with a uniform structure and composition. This limits their utility for use with the mixed, irregular stands that form much of our forest. They may well be gradually superseded by computer models based on data accruing from spacing studies such as those mentioned in the section on stand density.

The need still exists, however, for short-term growth predictions in the existing mixed and irregular stands. For several years, the Forestry Branch has been trying to develop empirical formulas from existing plot data to predict growth in such stands. Results have been promising for spruce and fir, but much work remains to extend them to other species.

Harvesting and Regeneration Cutting of Stands

Classical Studies

North American foresters have always been strongly influenced by the classical systems of sylviculture developed in Europe. These had the primary objective of producing the most wood per unit area of land that was consistent with the needs for regenerating the stand. Under this influence, numerous experiments in various forms of selection, shelterwood and strip-cutting were started by many agencies. The Forestry Branch is still maintaining a number of these experiments at various locations in both New Brunswick and Nova Scotia. It will shortly publish an Information Report on a shelterwood system for regenerating old-field white spruce in Nova Scotia.

Unfortunately, this type of sylviculture is expensive and demands skillful application and care in logging. Partly for these reasons, it has never been widely practised in eastern Canada. Recent trends in logging mechanization are making most of the classical systems even more impractical for large-scale application. They may still be useful and practical for some special-purpose stands, for small holdings, and on certain sites that for ecological reasons should not be clear-cut. But at present additional research on them should not receive high priority.

Impact of Mechanization

Increasing mechanization is revolutionizing logging techniques in "big" forestry. The trend is very strongly toward some form of clear-cutting. We do not know what impact this will have on the maintenance of site productivity, future stand composition and yield, or insect and disease damage in any residual stand. The effects will probably vary with the soil, species, and the actual technique of logging.

The Pulp and Paper Research Institute has started a study to determine the effect of mechanized logging on advance growth, seedbeds, the distribution and quantity of slash, and establishment of new regeneration. The Forestry Branch is conducting a parallel study in the Nepisiquit River Watershed of New Brunswick and supplementing it by observation of mechanized operations elsewhere in Nova Scotia and New Brunswick. Plans are also being made to determine whether mechanized logging gives rise to greater decay problems in any residual stands than the previously used conventional methods. However, since clear-cutting will probably be the prevailing custom, these may not be important.

This research is essentially survey in nature, very time-consuming, and not too productive of results. It should be left to the Pulp and Paper Research Institute in collaboration with industry. The Forestry Branch should focus its attention on the more urgent tasks of determining the nutrient drains entailed by such practices in relation to the nutrient capital of the soil, and the measures needed both for maintaining the productivity of the sites and regenerating them either artificially or naturally.

Both the Forestry Branch and the Pulp and Paper Research Institute are conducting some research on the problem of nutrient drain elsewhere in eastern Canada. The local research on density studies already mentioned and fertilization studies being planned will be relevant, but additional local research on the nutrient uptake of entire stands will eventually be necessary. Research on regeneration will be discussed elsewhere because it transcends the question of spruce and fir management.

One undesirable result of the trend toward mechanization is neglect of logging equipment and techniques appropriate for operating small woodlots. Logging is becoming a full-time profession, and part-time operators have neither the capital to buy or rent modern equipment, nor the skill to use it efficiently.

PROTECTION

Spruce Budworm

Infestations of spruce budworm pose one of the most serious problems in the management of spruce and fir in New Brunswick. They occur periodically, usually when a cycle of weather favourable to the insect coincides with the existence of mature to over-mature forests of fir and spruce. Available evidence suggests that infestations began somewhere in New Brunswick in 1805, 1870, 1912, and 1949.

The current infestation started in northwestern New Brunswick and spread over nearly the entire province. It collapsed in the northern half of the province in 1959, but has persisted in central New Brunswick.

An experiment in spraying to control damage was made in 1952. The success of this operation led to the formation of a provincial Crown corporation, Forest Protection Limited, to conduct the operations; spraying

has continued every year since then except in 1959. Some 8 million acres have been sprayed one or more times, and the direct cost of the program has been about $20 million. This may sound expensive, but it has prevented appreciable tree mortality in a forest that is the resource base of an industry whose gross value of production is more than $125 million a year. The 1912-1920 outbreak caused mortality that was conservatively estimated at 20 million cords, mostly in the Miramichi Watershed. It ruined the lumber industry there and was undoubtedly responsible for the failure of the pulp and paper industry to develop in the Miramichi until the mid-1950's.

The development of the budworm infestation had been foreseen and the federal government in collaboration with the province and Fraser Companies Limited, instituted the Green River Project about 1945. The objectives were to determine whether damage could not be minimized by management practices and to document the epidemiology of a budworm outbreak. It speedily became apparent that management practices were of little avail on a short-term basis, but a wealth of information was gained on the dynamics of the outbreak in northern New Brunswick and this was published in a monograph in 1963. When the spraying began in 1952, the federal government agreed to provide the technical advice which Forest Protection Limited needed to plan its operations and to assess the biological results of spraying.

The current situation is that studies of the low endemic populations in northern New Brunswick are continuing; another research team is working on spraying operations in central New Brunswick; and different agencies have started a variety of studies of the side-effects of the spraying.

Dynamics of Endemic Populations

After a severe outbreak, the spruce budworm usually persists at low endemic levels for periods of 20 to 40+ years before a cycle of favourable weather for budworm development plus maturing of a susceptible forest sets the stage for another infestation. The situation in northern New Brunswick is unusual in that owing to spraying, the forest is still highly susceptible to budworm attack, and it is important to determine what factors are responsible for keeping the budworm at endemic levels. We cannot control weather nor (on a short-term basis) maturing of the forest, but knowing what factors control endemic populations may permit development of better methods to control the extent and intensity of outbreaks in the future.

Current emphasis in research is on sampling to get a reliable estimate of populations in different types of stands and to determine their fluctuation in relation to weather, parasitism, disease and other causes of mortality. Ancillary studies are in progress on differences in the vigour and fecundity of endemic and epidemic populations, on moth trapping, experimental populations, and tree-crown development.

One research officer is studying the role of birds in helping to maintain populations at endemic levels. Since endemic populations of

budworm are very low, a second officer is studying invertebrate predators and the role of other insects (principally the balsam fir aphid) that may be alternative sources of food for budworm predators and help maintain predator populations at high levels.

Incidental to this research on budworm, comprehensive knowledge has been gained of the epidemiology of several concurrent infestations of the back-headed budworm, a much less destructive insect.

Although the control operation did prevent very serious tree mortality in the north, many individual trees were killed and many more were defoliated severely enough to suffer top-killing and rootlet mortality. This provided infection courts for trunk rots to become established and many of the weakened trees were attacked by woodwasps which introduced sap rots. Considerable research has been done to determine the rates of deterioration of such dead and weakened trees.

Further, since the actual mechanism of damage was defoliation and consequent loss of the tree's ability to manufacture food by photosynthesis, studies were made and are continuing of the photosynthetic efficiency of various kinds of leaves and the effect of different degrees of defoliation on the tree's growth and ability to survive.

Research in Relation to Aerial Spraying

The purpose of the aerial spraying is to keep the forest healthy, not to eliminate the budworm; experience has shown that elimination is impossible in a major infestation. The organization and conduct of the spraying operation is the responsibility of Forest Protection Limited; the Forestry Branch is responsible for the research necessary to conduct an efficient operation and to evaluate the results. Close co-operation between the two agencies is essential and has been excellent.

In more precise terms, the immediate objectives of the Forestry Branch are: (1) to provide information on the distribution of the infestation and tree damage to allow planning of control operations; (2) to direct timing of spray applications in relation to seasonal development of the insect and host; (3) to assess immediate results of the spraying in reducing pest numbers and protecting foliage; and (4) to evaluate trials of alternative pesticides, and different formulations and methods of application. The long-term objective is to get a better understanding of the dynamics of the infestation and the influence of the control program on it and on the associated fauna and the forest itself.

Several methods are used to achieve these objectives. The effectiveness of different timings of sprayings is investigated. Defoliation is mapped by aerial reconnaissance. Through large-scale ground surveys larval and egg-mass populations are sampled to delineate infestation areas and allow decisions to be made on whether more spraying is necessary and, if so, where and how much. Similar surveys of surviving budworm and associated fauna are made to evaluate the effectiveness of the operation.

Selected areas are sampled intensively to evaluate operational trials of new formulations and materials. To supplement this research, each year staff from the Chemical Control Research Institute of the Department in Ottawa screen a variety of potentially useful insecticides in the field. This research has led to the replacement of DDT by Phosphamidon for use along salmon streams and may lead to the use of a new insecticide, Sumithion, for the whole operation. The great disadvantage of DDT is its persistence and toxicity to fish. Moreover, tests both at Fredericton and Ottawa indicate that budworm are becoming increasingly resistant to DDT.

To achieve the long-term objectives of the program, studies are being made on selected plots to determine the long-term effect of the infestation on the forest, the epidemiology of the investation, and the impact of the spraying.

Numerous ancillary studies have arisen out of this program. Space will permit mention of only a few. Co-operative studies are in progress with chemists at the University of New Brunswick to synthesize either the sex attractant of the female budworm itself or a closely related substance with similar powers of attraction. One compound, attractive to male spruce budworm moths, was identified in 1966. Such a substance may be valuable as a sampling tool and may lend itself to biological control of incipient outbreaks or infestations isolated from the main area of large outbreaks.

Budworm do not behave on red spruce the same as they do on white spruce or balsam fir, and sampling methods developed for the latter species are unsuitable. Since the abundance of red spruce in central New Brunswick may be accountable for the persistence of the infestation there, a suitable sampling technique is essential and efforts are being made to devise one.

DDT is a persistent pesticide which continues to accumulate in the forest floor for some years after cessation of spraying. What effect this has on the soil flora and fauna, decomposition of organic matter and circulation of nutrients is unknown.

The New Brunswick Department of Natural Resources recently reserved 1,000 acres on the Miramichi Watershed in an area with a very long spraying history for studies of the impact of DDT residues in the ecosystem. Scientists from the Forestry Department, the Department of Fisheries, the Fisheries Research Board, the Canadian Wildlife Service, Department of Agriculture, the New Brunswick Department of Natural Resources, York University, and St. Dunstan's University have initiated co-operative studies in the area to assess the burden of DDT residues in the plants, soil, water, and various indicator species of birds and animals, and the rate at which it disappears.

The effect of spraying on fish and wildlife has caused much concern. For some years, the Fisheries Research Board and the Department of Fisheries have been testing the insecticides used for both the operational and experimental spraying for toxicity to fish. This has been supplemented by field studies to determine how the salmon populations and stream bed

fauna were and are affected by the spraying. This has led to the use of Phosphamidon instead of DDT along salmon streams and a great consequent drop in fish mortality.

Unfortunately, Phosphamidon in concentrations higher than 1/4 lb. per acre proved to be very toxic to birds. The Canadian Wildlife Service, therefore, assigned a team of researchers to work with the foresters to assess the impact of pesticides on birds. This work has been a model of interdepartmental co-operation.

Uninvestigated Problems

Despite the fact that some 10 to 12 professional research men from various agencies plus a much larger number of technicians, students and others have been working on the problem for years, it is so complex that many aspects have hardly been touched. Most of the research on the actual insect itself has stressed population ecology and virtually nothing has been done on the genetics of the population and its response to changes in population size and the impact of spraying. One indication of change in the genetics of the budworm is growing resistance to DDT. Little work has been done on the actual physiology of the insect and its responses to nutrition and the physical factors of its environment, such as temperature, humidity, etc. No detailed studies have been made of budworm behaviour on red spruce, yet we suspect this species may be the key to the persistence of the infestation in central New Brunswick. This latter problem is complicated by the fact that red and black spruce hybridize freely and the degree of hybridization probably affects the susceptibility of the individual tree to budworm damage. Virtually no attention has been given to the interaction of budworm with other insects, such as the balsam woolly aphid. During the current year, research is being started on all these problems.

Many data exist on the impact of the infestation on the forests of northern New Brunswick, but no qualified man has been available to analyse it, and similar work has not even been started yet for central New Brunswick. As well as mortality, studies should take into account the loss of growth in surviving trees, trunk and root rot arising from defoliation, and the influence of the infestation and spray on the composition and structure of the forest. One of the long-term legacies of an unchecked infestation is either a young forest with an even-aged structure and a high percentage of fir in it, or a badly understocked forest which is expensive to log. This poses serious management problems in that it not only sets the stage for a new infestation, but it does not lend itself to continuous production of wood. Such a forest developed in the Miramichi Watershed after the 1912-1920 outbreak and its unbalanced age structure is causing management difficulty now.

The spraying itself gives rise to many problems. As indicated above, the impact of the insecticides on budworm has been given much study; considerably less attention has been given to their effects on salmon, some stream-bottom fauna, and some birds. A little work has started on soil organisms. But practically no work has been done on the many other animals that are probably affected. If we recommend continued

widespread use of pesticides, a moral responsibility exists to find out how these are affecting the ecology of the forest ecosystem as a whole and this implies much more research than is now being undertaken.

Finally, research is urgently needed on methods of control other than spraying. The use of the sterile male technique, sex attractants, hormonal control, combinations of viruses with weak applications of insecticides, and introduced parasites and predators has been suggested. Little has been done so far to determine the feasibility of these alternatives.

Current Situation

Defoliation during 1967 was very light for New Brunswick as a whole, although a few individual stands may have been severely defoliated. The egg-mass survey in central and southern New Brunswick has indicated a considerable decrease in 1965 larval populations, and areas with high populations will be much more scattered and smaller in area than in 1967. Since the forest is generally in good condition, an operational spray program is hardly warranted although an experimental program is desirable both for continuing research and to maintain a skeleton staff for Forest Protection Limited in event that operational spraying becomes necessary again in 1969.

A slight rise in budworm egg masses has been detected in northern New Brunswick, which will bear close watching because the forest there is still in a susceptible state.

Balsam Woolly Aphid

The balsam woolly aphid was introduced to Nova Scotia from Europe about 1900. It now occurs generally throughout Nova Scotia, Prince Edward Island, and southern and eastern New Brunswick. Spot infestations occur in west-central New Brunswick and the Gaspé Peninsula. A very serious infestation is present in western Newfoundland, and recently the insect has been discovered on Vancouver Island and the adjacent mainland.

It attacks the small twigs and branches in the crown, causing swelling and distortions (gout) which may kill the tree or make it flat- or dead-topped. It also attacks the stem, giving rise to dark red reaction wood in the growth rings. A heavy attack may kill trees in 1 1/2 to 2 years and lighter attacks reduce growth and lower the quality of the wood.

Research on the insect in the Maritimes began in 1931. The results to 1952 have been published in a comprehensive bulletin. The objectives of current research are: (1) to understand the climatic requirements of the insect so as to be able to predict the limits of its spread; (2) to determine why the insect is more numerous in one place than another and why its numbers fluctuate; (3) to determine the relation of population density to damage and to predict the future course of infestations in newly infested areas; (4) to introduce and establish predators that may be effective in controlling the aphid; (5) to determine the relationships between bark structure of fir and incidence of the aphid;

(6) to understand the relationship between the mode of aphid feeding, the balance of growth-regulating substances in attacked trees and the abnormal growth responses to attack; and (7) to determine whether chemical control is feasible with systemic insecticides.

Briefly, progress is as follows. Laboratory experiments have shown that the insect can survive in the coldest areas of the Maritimes and its range will gradually become much more extensive. The severity of attacks is much greater in maritime than in continental climates. In a maritime region, all crowns in an infested stand usually become populated. Few trees escape injury and many are killed. In a cool climate, the aphid rarely becomes distributed throughout the stand but occurs on scattered clusters of trees. On the infested trees, populations are usually restricted each winter to the stems, and severe winters usually cause the infestation to die out without causing serious damage. Studies are continuing on the relationship between dispersal and climate, changes in the quality of populations, and variations in the susceptibility of trees to attack.

Numerous predators have been introduced from Europe and Asia, but only a few have become established and shown much promise of being effective in control. The search continues and potential predators will be liberated as they become available.

The balsam woolly aphid is a very difficult insect to control chemically for several reasons. First, crown infestations are hard to detect until considerable damage has already occurred. Second, the insect spends most of its life cycle motionless feeding on the sap of its host; it is protected from contact insecticides by its waxy coating. A systemic insecticide that is absorbed by the tree and transmitted to the aphid via the sap is needed. Injecting these into the tree by hand is too costly and since the poisons themselves are usually highly toxic, only low concentrations may be sprayed from the air. Laboratory work has disclosed several potentially promising chemicals, but it is too early to say how practical their use will be in the field.

Continued effort is needed in the current investigations. Additional research is very desirable on the chemical interaction between the aphid and its host, on the mechanism and genetics of host resistance, on the possible correlation between aphid attack and root rots, and on the deterioration of aphid-weakened or killed trees.

Other Insects

Many other insects attack spruce and fir, but at present few cause serious injury to trees larger than seedlings. The only other insect now receiving much attention is the spruce sawfly. This is an introduced insect that theatened to be extremely damaging in the late thirties. Fortunately, a virus and several efficient parasites were introduced and provide one of the most successful examples of biological control. The sawfly is still being studied because the epidemiology of the virus is of great theoretical interest.

Rots and Diseases

The role of decay organisms and diseases is much less apparent than that of insects, but in the aggregate losses owing to decay are probably greater than those caused by any but the most spectacular insect infestations. As already indicated, trees weakened and killed by insects are prime targets for decays and much of the local research in this field has been aimed at determining the rate and extent of decay following insect attack, and this research will continue. In addition to this, however, extensive surveys of the incidence of rot in spruce and fir have been made throughout the Maritimes and correlations derived between the amount of decay, tree size, age, species, and, in some instances, locality. This work is potentially useful to the provinces in allowing them to estimate for cull in provincial inventories. New Brunswick has adopted the procedures developed by the Forestry Branch as an integral part of its inventory sampling. Their adoption in Nova Scotia is desirable.

Another current project is an investigation of the role of bacteria in decay development. Bacteria are commonly present in large numbers in the heartwood of fir and spruce and may either facilitate or inhibit the growth of decay fungi. A study is also in progress on the physiology of dwarf mistletoe. Locally, this is a parasite of spruce. Although it is not usually serious in the Maritimes, it is very damaging and difficult to control on pines and hemlock in western Canada and it is reported to be causing considerable damage to spruce along portions of the coastlines of Pictou and Antigonish Counties and Cape Breton.

REGENERATION AND REFORESTATION

NATURAL REGENERATION

The Maritimes are blessed by a moist climate favourable to tree growth, and re-establishment of a forest cover is usually prompt even after fire. Avoiding heavy destruction of existing advance growth during logging is generally the only precaution necessary in stands of spruce and fir. Getting natural regeneration of the species desired, however, is often a more difficult problem in other cover types. In the Green River Watershed of northern New Brunswick, for example, mountain maple is very aggressive on cut-over mixed wood sites and will pre-empt about 30 per cent of the watershed unless controlled.

Much research has been done in the Maritimes on the natural regeneration of spruce and fir, and we know a lot about its requirements, even if securing them is not always feasible. This research continues both in the field and laboratory. Relatively little work has been done locally on the problems of pine regeneration, but the necessary theoretical knowledge is available from research elsewhere. Local knowledge of the natural reproduction of hardwoods or other conifers is very scanty and, with the exception of mountain maple, virtually nothing is known about the ecology of shrubby or herbaceous competitors.

Local research has shown why brush killers are not very effective in controlling mountain maple and has also demonstrated the feasibil-

ity of its control by tractors equipped with root rakes. Fraser Companies Limited and the Forestry Branch are collaborating now in a trial of the technique and of the use of fire.

Brush killers and herbicides obviously have great potential utility in controlling competition to conifer reproduction. Numerous ad hoc trials have been made in the Maritimes, but there has been little systematic research, with the possible exceptions of the release work the J.D. Irving Company is doing in its plantations, and the recent aerial applications of herbicides by the Nova Scotia Sylviculture Section. The Department of National Defence has a continuing problem in keeping large acreages at Base Gagetown clear of regrowth and has requested advice of the Forestry Branch's timber disposal officer at the Base. This gives us an opportunity to observe the results of a large operational program, but the fact remains that there is no real expert in the field in the Maritimes testing new chemicals or techniques of application in forestry. Such a man would be desirable.

Scarification has been widely used in British Columbia, Alberta and Ontario to improve seedbeds for establishment of spruces and pines. The New Brunswick Department of Natural Resources is experimenting with it to get natural regeneration of jack pine. Controlled burning may also have some application, but success with fire demands skillful timing and favourable spring weather for germination of seedlings.

Obviously, much remains to be learned about the ecology of natural tree regeneration and practical measures to encourage it.

ARTIFICIAL REGENERATION

Owing to the prevailing belief that natural regeneration is prompt and certain in the Maritimes, widespread use of artificial means of regeneration has been slow to develop and very little research has been done on it. Unfortunately, large burns do not necessarily restock promptly, and when they do it is not always with species either well adapted to the site or commercially desirable. Roughly 10 per cent of the potential forest land in New Brunswick and Nova Scotia is understocked. Moreover, large acreages of farm land are being abandoned and their regeneration is often slow and the resulting stands understocked. Indeed, ARDA studies have recommended deliberate conversion of much marginal farm land to forestry. Even if advance growth is present, there are advantages to increasing the representation of valuable species. Finally, planting is not only the fastest way of putting much land into production, it gives control of both composition and spacing of the next stand.

There are two general techniques of artificial regeneration - direct seeding and planting. They share one problem in common, namely, seed supply. These topics will be discussed below.

Seed Supply

A rational policy on seed supply is essential for any major program of artificial regeneration. Seed from trees of poor form and vigour will tend to yield poor progeny. Plants from local seed will usually be healthier and grow faster than plants from seed collected far from the planting site. Since planting and seeding are expensive, common sense dictates that seed should be collected from good stands, and - regardless of where it is processed and the seedlings raised - the progeny should be used in the general region of their origin. J.D. Irving Company is trying to observe these general precautions. Hitherto provincial practice has not been good, although both New Brunswick and Nova Scotia are planning to improve their organization of seed collection and distribution of planting stock.

Seed collection zones should be established in the Maritimes, and good stands in each zone should be treated to encourage production of seed. This would entail eliminating poor trees, stimulating crown development by heavy thinning, and possibly use of fertilizers. The Forestry Branch has agreed to collaborate with the provinces in delimiting provisional seed zones this year. It would also be prepared to help finance treatment of some stands for seed production.

Since most conifers produce heavy crops at intervals of three to eight years, each province (or perhaps the Maritimes as a whole) needs a central seed-treatment station where seed can be cleaned, tested and kept in cold storage by seed zones. During heavy seed years, a major effort should be made to collect large enough crops to tide over the lean crop years. As a matter of routine, provincial forestry staff should be on the lookout for opportunities to collect seed in conjunction with logging when any exceptionally good stands are being cut. Except for experimental purposes, importing seed or plants from outside the Maritimes should be discouraged.

When these courses are being followed, research will be necessary to check whether the seed zones established are actually appropriate, to stimulate seed production, and to develop control methods against seed-eating insects.

Direct Seeding

Many trials of direct seeding have been made in the Maritimes and some have been very successful. Ingenious techniques have been developed elsewhere for site preparation, planting or broadcasting seed, protecting it from birds, rodents and insects. Seeding has the advantage of being cheap compared with planting and it can be done from the air on rough, inaccessible terrain where planting is not practical.

Unfortunately, direct seeding has the disadvantages that early growth is usually slow compared with that of planted stock; it is not suitable without extensive ground preparation where competition is severe, and on some soils subsequent mortality owing to frost heaving is great; and most important of all, success depends primarily on having favourable

spring weather during the year of seeding. In Cape Breton, for example, repeated efforts to regenerate clear-cut stands of balsam fir by direct seeding have failed owing to unfavourable weather.

Trials of direct seeding should not be discouraged, but opinions differ on whether it should receive much priority in research. It is doubtful that it should.

Planting

Plant Production

At present, the New Brunswick Department of Natural Resources raises a few hundred thousand seedlings and transplants for planting - mostly spruces and pine. It is experimenting with tublings and plans to establish a new nursery on a better site near Fredericton to replace the present one. The Nova Scotia Department of Lands and Forests is raising 1 to 2 million plants yearly, mostly at Lawrencetown. It is starting a transplant nursery in Cape Breton and plans to expand its production at Lawrencetown to about 5 million. The provincial Department of Agriculture has a small nursery in Prince Edward Island to raise plants, mostly for distribution to farmers. The federal Forestry Branch grows about 200,000 trees at the Acadia Forest Experiment Station for experimental purposes, mostly for the tree-breeding program. The only really large nursery is that of J.D. Irving Company at Juniper, whose annual production is about 4 million, but plans are underway to increase production to at least 6 million. The Irving Company is reputed to be spending about $500,000 a year on plant production and establishment and care of plantations.

Efficient production of conventional planting stock is not usually possible in nurseries producing less than 2 to 3 million plants a year. The older a nursery is, the greater become problems in maintaining soil fertility and controlling damping-off fungi and insects; the particular problems are usually unique to the individual nursery and have to be solved locally. Fortunately, the Canada Department of Agriculture has been most helpful in Nova Scotia. Until recently, the Forestry Branch has not had suitable specialists on its staff to give the help needed.

The technique of growing seedlings for six to eight weeks in open-ended plastic tubes or sleeves and planting the tube with the seedling in it has been pioneered in British Columbia and Ontario. New Brunswick, Nova Scotia and Nova Scotia Pulp Limited have made trials of this procedure, but it is too early to say how successful they are. The method has the advantages that planting stock can be produced much more cheaply and quickly than by conventional nurseries; the planting season can be extended from early spring to late fall instead of being limited to short periods in the spring and fall; and the planting itself is easier and quicker than with conventional planting stock. The seedlings, however, are much smaller than the nursery transplants normally used and, consequently, their early growth is slower and they are not suitable for sites where competition is severe. Problems have also arisen with drought and frost-heaving on some sites.

Additional research is needed to develop better containers and to overcome problems of plant production that will undoubtedly arise. Nevertheless, the method has great potential promise for lowering costs of reforestation.

Plantation Establishment

Five questions have to be considered in relationship to plantation establishment: choice of species, planting sites, planting techniques, care and management of young plantations, and the economics of reforestation.

On choice of species, most foresters think automatically of the spruces because of their current desirability for pulp, and of red and jack pine because they grow well on poor sites. Only recently has the idea been seriously considered that we should be thinking in terms of efficient fibre production, and that - for many sites - species such as larch or aspen may have considerable promise. Virtually nothing has been done on the nursery problems of raising species such as fir and larch. The Forestry Branch has done considerable preliminary research on the introduction of exotics, and these have much promise for certain areas. The Nova Scotia Department of Lands and Forests has some experience in raising hardwoods.

The situation is similar with regard to planting sites. Frequently land has been planted simply because it was treeless without regard for the potential return or the suitability of the species used. No systematic effort has been made to establish small planting trials of different species over a wide range of sites and regions, yet this is essential if any major planting programs are to be put on a sound basis.

Research is needed on methods of site preparation and planting. Current planting methods are usually labour-intensive, which makes them expensive and often impractical on a large scale. Development of planting machinery appropriate for rough, stony land is probably essential for large-scale economic planting.

Problems of site preparation and planting merge with those of plantation care and management. On many sites, cultivation or use of chemicals may be necessary to control competition. Different species and sites will demand different spacings and cultural care. New insect and disease problems will become important, e.g., the European pine shoot moth, root collar weevil, white grubs and the larch sawfly, root rots caused by _Armillaria mellea_, _Fomes annosus_, and fire blight fungi.

Economic studies of all steps in the process of reforestation are highly desirable, e.g., seed production and nursery operations, planting techniques, choice of species, the relative return on different sites, etc. In addition, an economic analysis of the broad question of reforestation is needed. This should take into account not merely the cost and return of planting a given acre, but consider questions of transportation, costs of logging, and all the benefits that may arise from the maintenance or expansion of the wood-using industries.

To sum up, large-scale artificial regeneration would undoubtedly increase productivity greatly and allow much heavier cutting in existing stands than might otherwise be justifiable. If the provinces decide that major increases in planting are desirable, the Forestry Branch should try to recruit at least two specialists to work full time on the problems of reforestation. These men should work closely with the provinces and industry, and will need the help of specialists in tree breeding, soils, pathology and entomology.

TREE BREEDING

Spectacular advances have been made in agriculture through choice of good seed and through breeding for special characteristics. Comparable advances are possible in forestry, although, owing to the longevity of trees, progress will be slower. As planting programs increase in size, the urgency for making available better planting stock also increases. The Forestry Branch began tree-breeding research in the Maritimes in 1953.

There are three general methods used in tree breeding: provenance testing, selection of elite individual trees, and breeding for specific characteristics such as rapid growth, high-density wood, good form, frost hardiness, and resistance to disease and insects.

Most of the emphasis in the Maritime program so far has been on provenance testing. This entails getting samples of seed or plants of both native and exotic species from part or the entire range of each species and establishing planting trials with the seedlings in a variety of areas. The purpose is to learn something about the natural variation within each species and to find local or geographic strains that grow particularly well under Maritime conditions. Tests are in progress on the local spruces and fir; Norway spruce, Japanese, European and the local larch; red and jack pine, a variety of exotic firs and pines; and a few hardwoods. Large international trials of Norway spruce and yellow birch were to be planted in 1968.

In most natural populations, some individuals are outstanding in growth and quality. Seed samples of these elite trees are collected to determine whether the parent passes on its outstanding characteristics to its progeny. Cuttings are taken so that the tree can be reproduced vegetatively and these plants used for controlled breeding. Most of the local work of this sort has been on red spruce.

The research in controlled breeding as opposed to provenance testing so far has centred around hybridization of firs and larches, but is being expanded to include work on spruces and pines.

The long-term implications of this research for reforestation are obvious. In the short term, knowledge gained in the program will be helpful for establishing boundaries of seed zones and in recommending trials of certain exotic species for specific areas. Its expansion will depend on how much emphasis the provinces plan to give artificial reforestation.

MANAGEMENT OF HARDWOODS

ECOLOGY AND SYLVICULTURE

Research on the ecology and sylviculture of hardwoods can be summarized briefly. Very little has been done on it and we depend primarily on research done elsewhere for our knowledge of their sylvics. This state of affairs is owing partly to the lack of demand for hardwoods, partly to the use of the best hardwood land for agriculture, and partly to the fact that many stands are sylvicultural slums because of the combined effects of birch dieback, the beach bark disease, and high grading for the best yellow birch and sugar maple logs.

The Nova Scotia Department of Lands and Forests is doing a little research on management of sugar maple for syrup and sugar production. The Forestry Branch has made a few thinning trials in sugar maple and yellow birch in central Nova Scotia. Trials of site preparation with bulldozers in derelict or logged stands of tolerant hardwood and planting with spruce are promising in both New Brunswick and Nova Scotia. J.D. Irving Company is doing some very interesting work on a large scale on logged hardwood land in northern New Brunswick. Heavy land-clearing equipment is being used to prepare the sites for planting to spruce, and the trials are apparently succeeding.

Prof. K. Greenidge of St. Francis Xavier University is doing some excellent work on the distribution and water relations of hardwoods in Cape Breton Island, but his research is of a highly theoretical nature. Graduate students from Acadia University have made miscellaneous ecological studies of hardwoods under the direction of Prof. E.C. Smith. A graduate student from the University of New Brunswick is currently working on the phytosociology of tolerant hardwood stands in southwestern New Brunswick.

The comparative neglect of the sylviculture of hardwoods is unfortunate, not only because demand for them is rising, but because they occupy much of the best forest land of the Maritimes. The Forestry Branch has one research officer working on the ecology of hardwoods, but obviously this is inadequate.

PROTECTION

Although research on the ecology and sylviculture of hardwoods has been scanty, much work has been done on a variety of insect pests. Two of these investigations merit specific mention, namely, those on the winter moth and fall webworm.

The winter moth defoliates many broad-leaved trees, but especially red oak. It is a European insect that was introduced to Nova Scotia without its native parasites and this made evaluation of biological control attempts of particular interest. Two species of parasites were introduced and the objective of the study was to develop a mathematical model of epidemic and endemic populations of the winter moth and its parasites that would lead to deeper understanding of the behaviour of insect populations and to better methods of control. In point of fact, the parasites do seem

to be giving effective control and this has been reinforced by the discovery and deliberate spreading of a virus disease that attacks the winter moth.

The fall webworm is not an important economic pest in the Maritimes, but it has certain characteristics that make its study of great theoretical interest. Nearly all the intensive population research on insects in the Maritimes has been and is being conducted on insects of considerable economic importance; that is, on species that are not well regulated by natural feedback mechanisms. It became apparent during the spruce budworm studies that we required for comparative purposes a knowledge of the population dynamics of one or more of the typical insects, which never escape natural control. The fall webworm was chosen as a species that might produce the maximum information for a minimum of staff time. Briefly, the objectives of the research are: (1) to develop adequate mathematical models to describe and explain changes in population numbers from year to year; (2) to test the "key factor" approach as a tool in population research; and (3) to make a contribution to the development of general population theory and principles.

Considerable research has also been done in the field of pathology. In the 1940's and early 1950's, most of the mature yellow and white birch was killed or severely injured by a disease known as birch dieback. Many theories were advanced as to its cause and much research was done on it, but its cause was never determined. The disease itself seemed to disappear by the mid-1950's, but it left a legacy of many stag-headed birch trees, and an investigation was started on the nature and rate of decay in these trees. Several papers on this research have been published.

An interesting and potentially important sidelight has come out of the project. Among the organisms isolated from yellow birch was a species of *Cryptosporiopsis* that seems to inhibit the growth of many other fungi and bacteria. Since *Cryptosporiopsis* has virtually no effect on wood, it could conceivably be a valuable deterrent to wood destroyers in large stock piles. Research is in progress to isolate the substance responsible for the inhibitory effect and if this can be produced in quantity, it may turn out to be an antibiotic of considerable value in medicine and agriculture as well as forestry. Very encouraging progress has been made during the last year.

OTHER RESEARCH

Christmas Tree Production

Although the aggregate value of Christmas tree production is not very high, it is a valuable source of revenues for many farmers and owners of small holdings. With good management, fir and spruce Christmas trees will yield a higher return than growing pulp or lumber. But revenue depends largely on quality of the trees, and this can be greatly improved by cultural methods. Research is in progress to develop methods of pruning and shearing that will produce high-quality Christmas trees. A little work is also in progress in the tree-breeding program to find exotic species

suitable for Christmas growing in the Maritimes. Research is planned on the use of fertilizers, and work is needed on control of insects that lower the quality of trees.

Fire Research

Fire control is perhaps the most costly single activity of the provincial forest services and the amount of research devoted to it should be commensurate with its importance. Unfortunately, little effort is going into formal research on fire - not because the desire is lacking but because it simply has not been possible to recruit men interested in or competent to do research on fire. This situation is general across Canada.

The Forestry Branch has developed - and is now attempting to improve - a system of forecasting fire hazard that is very useful. However, this is the Branch's sole current effort in the Maritimes. It is also financing some interesting laboratory research on fire behaviour in the University of New Brunswick Department of Chemical Engineering.

Additional research is urgently needed on improving fire-danger tables and the precision of hazard rating and forecasting, on fire behaviour in the field, the possible use of fire as a tool of management, the influence of fire on site quality, and the economics of fire control.

An encouraging local development is the decision of the University of New Brunswick to offer a Master's Degree course on fire research and control as a joint major in the Departments of Forestry and Chemical Engineering. This is urgently needed and may help solve the problem of getting trained staff to work on fire research.

Logging

Government agencies are not organized to conduct efficient research on logging techniques; consequently, this has remained almost entirely the preserve of private industry. Large companies such as Fraser Companies Limited, Bathurst Power and Paper, New Brunswick International Paper, Nova Scotia Pulp, etc., have undertaken considerable applied research on their own operations. The Irving interests actually build their own skidders. The New Brunswick Forestry Extension Service has an ARDA grant of about $73,000 to develop appropriate logging techniques for use in small, partial-cutting operations.

Prof. L.R. Seheult of the University of New Brunswick is planning to write a book on logging in eastern Canada that will deal with principles as well as current techniques.

Logging research can be very expensive, and probably lies more properly in the demain of industry and equipment manufacturers than of government. However, the possibility of collaboration between the Forestry Branch and an organization with engineering capability (such as the New Brunswick Research and Productivity Council) for mechanization

of operations (such as thinning) is perhaps worthy of consideration. Collaboration between the Forestry Branch and industry on economic studies of logging would also be useful.

Mensuration

Mensurational research is aimed primarily at developing techniques for collecting and analysing forestry data efficiently. Mensurationists are as scarce as forest economists; there are perhaps two in the Maritimes giving much attention to research.

Prof. A.L. Van Slyke of the University of New Brunswick, is doing some work on efficient experimental designs for thinning experiments. The Forestry Branch studies on spacing and density of spruce and fir stands and development of formulas for growth prediction have been mentioned. A study is also scheduled on the volume of trees and logs. Recent research has revealed large discrepancies between the actual volumes of logs and bolts and those calculated by the formulas currently used. The proposed investigation will entail the use of a special immersion tank to get accurate volume data for different species and size classes of trees, and it will probably lead to revision of the currently used volume tables, formulas and certain scaling techniques.

The research in progress, however, does not even scratch the surface of that which needs doing. Additional mensurationists are urgently needed.

Economics and Forest Management

As is apparent from previous sections, most of the federal and provincial research is oriented towards growing, reproducing and protecting the trees. Very little has been done in the area of forest economics or forest management in the broader sense. This is not because the need is not great - the scope is virtually unlimited. However, suitably trained men simply have not been available despite efforts to recruit them.

Recently the Nova Scotia Department of Finance has assembled a core of economists to assist the Voluntary Economic Planning Board. Several have made broad resource and industry studies, including the field of forestry.

Some of the economic and management questions which require researching are the following.

<u>The Economics of Land Use</u>. Although foresters are inclined to overlook the fact, they are in the business of land management and not solely in the business of growing and harvesting timber. Land management should aim at producing the optimum goods and services for society, whether these be wood, recreation, wildlife, agricultural products, water, or a combination of these products. The ARDA surveys of land capability should be coupled with economic studies of land use.

The Cost of Growing Wood. We have very little knowledge of the real cost of growing wood, yet this would seem basic to many management and policy decisions.

Economics of Sawmilling Vis-à-vis the Pulpwood Industry. Both New Brunswick and Nova Scotia are facing a difficult problem in deciding whether it is desirable to take special steps to save a portion of the sawmill industry, and, if so, what portion and how. Economic information is essential for wise decisions.

Forest Policy in Relation to Stumpage Fees Versus Indirect Benefits of Industry, and its Implications for Management of Crown Lands. This is a very contentious area that is entirely a matter of provincial prerogative, but it is an important one on which objective study is desirable. Briefly, many authorities believe that stumpage is an inefficient way of collecting revenue from Crown lands. Vastly greater return would accrue from the indirect benefits of switching to some form of land rent that would put pressure on industry to use land more efficiently and encourage investment to make the land more productive. This implies, however, that an industry acquires some equity in the forest and is assured of reimbursement should the government cancel its licence.

Contrasting approaches to this problem have been taken by Ontario and British Columbia. In Ontario, the provincial government has assumed responsibility for management, and either undertakes the sylvicultural work necessary to keep the land productive, or pays industry to do it. Industry has no equity in the wood until it is cut. British Columbia has established timber-management areas on long-term leases. It has set the allowable cut, but any investment the licensee puts into the forest to increase its productivity increases his allowable cut. He also has to regenerate logged-over land, or the province does it at his expense.

Both approaches have their advocates, and much could be said about the relative advantages and disadvantages of the two systems. Their study, however, is much to be desired.

What Constitutes Merchantable Wood? The Nova Scotia Forest Practices Improvement Act specifies that under certain circumstances all merchantable wood must be logged, and the local boards responsible for administering this Act urgently need guidelines to decide what is merchantable. This, of course, varies with the logging chance, logging methods, distance of transportation, local markets, etc. But a few case studies would be very helpful in establishing guidelines.

These problems are only a few that need study. As mentioned above, the great bottleneck is availability of resource-oriented economists. The Forestry Branch has recruited two and may be able to get another. The Department's Forest Economics Research Institute is now planning its program for the next few years and may be able to offer some help on local problems. Another possibility is hiring university faculty on contract to undertake economics research.

Special Land-Management Problems

Forestry is largely land management. Each region has its own peculiar problems and much of this discussion could have been organized around specific land-management problems had it been convenient to do so. Two special problems, in which forestry is only part of the picture, illustrate this point.

The first of these is an area of about 140,000 acres of Crown land in southwestern Nova Scotia known colloquially as the Yarmouth/Shelburne Barrens. This area is mostly treeless and supports a non-productive heathy vegetation. The Nova Scotia Department of Lands and Forests has requested the Forestry Branch to investigate the possibilities of afforestation, and this research is in progress. Early results indicate that the core treeless area is only about 70,000 to 80,000 acres.

The second area comprises about 8,000 acres of strip mining for coal near Minto, New Brunswick. The New Brunswick Department of Natural Resources is investigating the possibilities of this area for forestry, agriculture and recreation, which will probably entail some research.

APPLICATION OF FORESTRY RESEARCH RESOURCES

Organization

The chief agency conducting forestry research in the Maritimes is the Forestry Branch of the Canada Department of Forestry and Rural Development. Its headquarters are at the Forest Research Laboratory on the campus of the University of New Brunswick. It has a small office in Truro, Nova Scotia, from which the provincial forest insect and disease survey is conducted, and a 35-square-mile experiment station whose headquarters are about 16 miles from Fredericton.

Most of the laboratory research is conducted at Fredericton. During the field season, staff are dispersed throughout the Maritimes as the research in progress demands. The largest semi-permanent summer field station is maintained in the Green River Watershed of northern New Brunswick in collaboration with Fraser Companies Limited, and the New Brunswick Department of Natural Resources. Much of the Forestry Branch's field research is done in varying degrees of collaboration with the provincial departments and industry. Space will not permit description of the gamut of arrangements involved, but many are intimate. Those with the universities will be discussed later.

No other agency in the Maritimes has forestry research as its main objective, but a considerable amount is done by university faculty and graduate students, and the staff of the provincial departments and some companies. It is almost impossible to gain any quantitative estimate of this latter research, however, because there are usually no sharp boundaries between graduate instruction and research, and between provincial and industrial research and development and operational trials.

Staff and Financing

By March, 1968, the professional staff of the Maritimes Region of the Forestry Branch numbered 58, of whom about 50 are engaged in full-time research. The total supporting staff includes about 135 full-time employees and about 45 man-years of casual or seasonal employees. The operating budget for 1967-68 was $290,000 (exclusive of salaries) and the capital vote (exclusive of major contraction) was $160,000. Salaries and wages total about $1.2 million. These figures make no allowance for research staff from Ottawa (e.g., the Chemical Control Institute) who spend considerable time in the Maritimes.

In addition to research actually conducted by its own staff, the Forestry Branch made $45,000 available in Extramural Research Grants for six projects at the University of New Brunswick and two at Dalhousie during 1967-68. This level of support will probably increase gradually. It also made a grant of $40,000 to the University of New Brunswick to encourage graduate training and research in forestry, and this amount is tentatively scheduled to increase considerably during the next four or five years.

Apart from the above figures, it is difficult to make a realistic estimate of the expenditures on forestry research. It is probable that more than $200,000 a year is spent by agencies other than the Forestry Branch on research relevant to forestry.

Research Policy

There has been no comprehensive statement of research policy for the Forestry Branch or any other agency in the Maritimes. For the Forestry Branch at least a statement is long overdue. Framing one is not easy, but the following comments may be helpful.

Professional researchers are a scarce commodity and each costs about $40,000 a year to support in salaries and equipment. They should not be used for survey work that provincial and industrial agencies are competent to handle (e.g., regeneration surveys), or for production work for normal management purposes (e.g., seed and planting stock).

They should be devoted to research of two kinds: (1) research to solve problems that exist today and which need answers today - answers that will be used immediately they are known, and (2) research that will place us in a good position to answer the questions that will be pertinent at some future date - answers that will remain valid for some time. This means that professional researchers should not become deeply involved in *ad hoc* studies unlikely to yield clear-cut useful answers, or studies referring to a single empirical situation that is unlikely to be duplicated.

Again insofar as possible, researchers should not be working singly on a large variety of unrelated problems. Most serious problems demand an interdisciplinary team effort in which the work of one researcher supports that of another. We have some instances of this approach in the Maritimes. The research on the spruce budworm and the balsam woolly aphid

are good examples, and the studies of density and stand productivity are beginning to achieve this ideal. Unfortunately, much of the research effort in the Maritimes has been ineffective owing to its scattered superficial nature, and the pressure to tackle too many things in a superficial way is still very strong. An urgent need exists for troubleshooters.

During the past two years, encouraging progress has been made in integrating university and federal research. Two extramural research grants to the University of New Brunswick Department of Chemistry entail close co-operation between federal and university staff. Prof. Krause is giving the lead in the field of forest fertilization. The Department of Biology has submitted an application for a grant that would also dovetail nicely with federal research in progress. Several graduate students from the Faculty of Forestry are receiving research direction from federal staff.

Collaboration of this sort is highly desirable and should be extended not only by means of grants but by contract research. At present, federal agencies have no administrative machinery for subsidizing through the winter months graduate students whose research they are directing. This problem needs solving. Much closer contact should also be established between the Forestry Branch and other Maritime universities.

Effectiveness of Research

No simple answer is possible on the effectiveness of research. Much of that conducted by industrial or provincial agencies to solve internal problems never becomes public knowledge. However, it is possible to make some judgment on the research of the Forestry Branch and its predecessor organizations.

Most of the Branch's research on the biological aspects of forestry has been effective in one or other of three ways. First, some has produced answers or information that has been of immediate use in solving some management problem. Much of the research on budworm, the introduction of parasites and viruses to control the spruce sawfly and winter moth are good examples. Secondly, some of the research has supplied background information that is useful in organizing one's knowledge of the forests or in understanding the phenomena one observes in the woods. Louck's forest classification of the Maritimes and much of the research on the sylvics of tree species fall in this category. Finally, much of the research on problems such as the dynamics of insect populations, the physiology of trees, etc. has produced biological knowledge of lasting validity, whether or not it is of any immediate use.

The research on fire-hazard ratings and forecasts has been highly effective and useful to both provinces and industry. Mensurational work, such as development of form-class volume tables, or gathering data on growth, has yielded valuable working tools or information useful to management.

The situation is less happy with the so-called practical research

on applied sylviculture; there is much unused research literature in this field. So far industry has not had to make investment in sylviculture a normal part of its operating practice. Consequently, much of the research in this field has been conducted in a vacuum; some has been based on European methods which for social and economic reasons are inapplicable in Canada; and some has been so conducted that the results cannot be extrapolated beyond the particular local problem.

CONCLUSIONS

The amount of research being done is small in relation to the importance of the wood-using industries to the Maritimes and the problems to be solved. One is tempted to order more of everything. Research talent, however, will always be a scarce and expensive commodity; hence it should be directed to the areas that will yield the greatest return.

Some of the general problems requiring attention include the following:

1) Expansion of the federal research staff will be limited. An effort should be made to augment its resources by enlisting greater university participation in research by means of block grants to encourage graduate research, extramural research grants, departmentally financed scholarships, and greater use of contract research. Assistance should not be limited to one university or department (although forestry and biology should receive emphasis), but should go to any department able and willing to undertake forestry research.

2) The Forestry and Biology Departments at the University of New Brunswick lack adequate facilities for graduate training or research in forestry.

3) More emphasis should be given to thinking of research in terms of natural-resource management rather than purely forest management. Efforts should be made to disseminate research information more widely among all the agencies engaged in research on and management of natural resources and, if possible, to get better co-ordination of their efforts.

4) Since federal research staff will always be scarce in relation to problems needing research, the Forestry Branch should not become involved in survey work that industrial or provincial agencies are competent to handle (e.g., regeneration surveys), or in production work (e.g., seed and planting stock) for normal management purposes.

5) The Forestry Branch should endeavour to develop its Management and Liaison Section into an efficient organization for getting research information and results to the consumer.

The major areas in which research should be expanded are (1) land classification, to enable realistic decisions about land management and industrial expansion; (2) problem areas in which research may lead to major increases in productivity either by enhancing merchantable yield

or diminishing losses; and (3) economic studies to determine the feasibility of cultural measures proposed and to enable development of forest policy.

Land Classification

Since land classification is essential to realistic decisions on land use, for management planning, taxation, etc., the Forestry Branch should increase its research effort in this field and other federal agencies should be encouraged to second appropriate specialists to make possible an integrated classification of the land's physical resources. The provinces should be prepared to recruit staff qualified to complete the land classification of the Maritimes when the technical problems have been solved.

Sylviculture

The greatest increases in productivity are likely to result from manipulation of stand density of the young to middle-aged stands that will provide most of the wood in the next rotation, fertilization, and artificial regeneration of unstocked land. If this reasoning is valid, it has the following implications:

1) Emphasis should be on good sites that will yield the greatest return per unit of input. We should not be seduced into putting great effort into the often intriguing problems of poor land.

2) Emphasis should be given to studies of stand density, spacing, the physio-ecological basis of tree growth, and development of modelling techniques to predict the effect on growth of manipulating stand density and to enable comparison of management alternatives.

3) The Forestry Branch and universities should devote major effort to the problems of tree nutrition and to determining the responses possible with fertilization. Development of operational techniques for applying fertilizer should be done by the provinces and industry.

4) A greatly increased program of reforestation is desirable. The Forestry Branch should recruit additional staff to work in this field and the provinces should consider the desirability and feasibility of some common effort in seed handling and storage and in nursery production.

5) Large-scale cleaning, thinning, and site preparation will have to await development of suitable machinery. This will be expensive, and the engineering capability would not be easy to find in the Maritimes. Since the Ontario Department of Lands and Forests, the John Deere Company, the Caterpillar Tractor Company, and Logging Research Associates are in or intend to get into this field, no great effort is warranted in the Maritimes.

6) Some provincial and industry decision should be made on the priority to be given research on hardwoods.

Protection

No great increases in the resources devoted to entomological research are warranted at present in view of the effort being put into other fields. The research in pathology will probably have to be expanded materially if the program of reforestation increases. A major increase in fire research is desirable.

Recreation

The use of forest land for recreation is increasing very rapidly. Research in this field is desirable and some decision should be made on what agency is to conduct it.

APPENDIX B

FORESTRY RESEARCH IN NEWFOUNDLAND

This report is a summary of current forestry research in Newfoundland. It emphasizes activities of the Department of Forestry and Rural Development, and includes studies by other forest agencies. A brief historical review of the department's research organization is presented as well as plans for future development in staff and facilities.

APPLICATION OF FORESTRY RESEARCH RESOURCES

Historical Development

The present research group developed from two separate elements, one oriented toward studies of insect and disease problems, the other concerned with sylviculture and forest management research. The two elements were originally established in separate geographic locations.

At Corner Brook a Forest Insect and Disease Survey group was established in 1950 to conduct annual surveys of insect and disease pests and to undertake research on their biology and control. During the initial years the staff consisted of a research officer and two technicians. By 1965 the professional staff had increased to five and the support staff to six. In St. John's a District Office of the Forest Research Branch was established in 1950, primarily for investigations on sylvicultural problems. Research in forest ecology was added later and by 1965 the number of research officers was six with an equivalent number of technicians. Reorganization of the department in 1965 amalgamated the two units.

Although amalgamation was achieved in 1965 a decision to locate regional headquarters at St. John's was not made until the spring of 1966. Serious problems related to obtaining laboratory and office accommodations were immediately evident. These are now being resolved by developing temporary facilities at a former army building at Pleasantville. Amalgamation of the St. John's and Corner Brook groups was completed in 1967.

Laboratory and Other Facilities

The temporary accommodation at Pleasantville provides approximately 30 offices and 10 laboratories. In designating laboratory space

emphasis has been placed on such activities as soils and land classification, forest pathology, forest entomology, forest genetics and physiology, and controlled environment rooms for the Forest Insect and Disease Survey. Concurrent with this development, plans have been made for new accommodations which are expected to be located on the Campus of Memorial University of Newfoundland. It is anticipated that the new building will be completed about 1970-71. Present facilities will, it is hoped, be reasonably adequate and provide for the needs of the research staff. However, considering the problems of recruiting and holding professional staff in Newfoundland it is important that modern facilities for scientific research be developed as soon as possible. Location on the university campus will be an important factor in attracting and holding competent researchers because it will enable a closer association between scientists of the department and the university in similar and related disciplines.

The Region has also established several seasonal field stations. Seasonal headquarters for Forest Insect and Disease Survey districts have been provided at Clarenville and Badger and a third is contemplated at Stephenville Crossing. A research station for a staff of 10 was established in 1966 at North Pond in the Gander area to study problems of reforestation of burned land. In 1967 a large field station capable of accommodating a seasonal staff of 40 was established at Pasadena near Corner Brook. This will serve as headquarters for research activities in western Newfoundland.

Staffing

Plans for staff expansion were initiated in 1965 to bring the Newfoundland establishment to a total of 40 research officers and a support staff of over 100 by 1971. In 1967 staff consisted of 19 professionals on strength, five more to report before the end of the year and about 35 man-years of support staff, including student assistants. It is anticipated that technician staff in support of research officers will be in the approximate ratio of two to one by 1971.

The current demand for men trained to conduct forest research is high in all regions of Canada, but at the same time the numbers available are limited. The lack of good research facilities, professional isolation, general underdevelopment and comparatively high living costs in Newfoundland have made recruitment difficult. Some of these problems are being resolved and it is hoped that future experiences will be less frustrating.

The research program has been slow in developing because of staffing difficulties and because, unlike other regional forest research establishments, the initial staff was small presenting a rather limited base on which to develop the larger organization. It takes time to integrate new staff, and in many cases recruitment has been at junior levels of training and experience requiring an additional training period in specialized fields. In 1967 eight research officers were absent on educational leave.

The recruitment of trained technicians has been equally difficult.

The supply of men with forest technology training is limited, and graduates of the Maritime Ranger School and the College of Trades and Technology are in high demand by industry, the Provincial Forest Service and the department. Under present circumstances, there is competition for technicians between the department and the Provincial Forest Service, a cause of occasional friction between the two organizations. Obviously, it is not in the best interest of the department to increase its technician strength at the expense of the province. It is hoped that in a few years this problem will be overcome; it is encouraging to see that the teaching staff and size of forestry classes at the College of Trades and Technology are being increased.

Relationships with Other Forest Agencies

Every effort has been made to orient the program toward satisfying the research requirements of the Region. A close relationship has existed between the Department of Forestry and the principal forest agencies. Close liaison has been achieved through personal contacts and more formally through such groups as the Forest Improvement Committee of the Newfoundland Forest Protection Association and the Forest Research Advisory Committee. The Forest Imporovement Committee was organized five years ago primarily to consider problems related to balsam woolly aphid infestations but now is concerned with all forestry problems. It includes representation at the Regional Forester and Section Head level and recommendations are made to the Controlling Committee of the Newfoundland Forest Protection Association. The Controlling Committee is composed of senior officials of the principal forest agencies. The Research Advisory Committee was organized by the department to advise on research requirements and to establish project priorities. It includes senior level representation from the forest agencies, the pulp and paper companies, the university, the Department of Agriculture Experimental Station and the local sawmilling and plywood industries. The Advisory Committee meets at least once annually. In addition to these committees a Research Officer has been assigned to part-time liaison duties which include periodic discussions with officials of industry and the province, and distribution of pertinent literature. This research officer is also responsible for planning and conducting field trials and demonstrations of research results and recommended forestry practices.

The need to maintain a high level of liaison and a close working relationship with the various forest agencies is imperative if the research program is to meet the requirements of forestry in Newfoundland. The relationship with the Provincial Forest Service is especially important because of the division of responsibilities in Canada which gives the federal department responsibility for conducting research and the provincial authorities responsibility for forest management involving the utilization of the results of research. It is imperative that problems and plans of the Provincial Forest Service be carefully discussed with research staff of the department and vice versa. Some difficulties are perhaps inevitable because of the relatively long-term nature of many research projects in forestry and because of the current difficulties in recruiting competent research staff in activities where they are vitally required.

The department's liaison role is to be strengthened in the near future by the appointment of an information officer.

THE RESEARCH PROGRAM

Considering the proposed expansion of the pulp and paper industry in Newfoundland and the concern expressed by forestry officials over the ability of the resource to meet future requirements, the primary problems of forestry in Newfoundland are those associated with increasing wood production and reducing losses from insects and diseases. These views are similar to those expressed at the National Forestry Conference at Montebello in 1966 which predicted a wood scarcity in Canada by the year 2000.

It appears logical that the department's maximum effort should be concentrated on the Island of Newfoundland for the next eight to ten years. Work in Labrador during this period would be limited to reconnaissance-type projects involving primarily insect and disease surveys and soils and site studies. This policy is suggested because of the magnitude of problems on the Island of Newfoundland and because of the relatively easy accessibility of established and proposed industries to forested areas. It seems apparent that the problem of wood scarcity will be acute on the Island by the year 2000. The availability of research staff over the next few years will also have an important bearing on expansion of work in Labrador.

Sylviculture and Related Research

Research in sylviculture is concerned primarily with problems associated with the growing of trees and the management of forest stands, to achieve maximum production. It deals with reproducing forests both naturally and artificially and with cultural practices, e.g., thinning and fertilizing for increasing yields. In terms of direct application to forestry it is one of the most important of the research activities and incorporates many of the results of research from other disciplines in developing its program. The ultimate objective of sylvicultural research is to integrate the results of fundamental and applied research into systems of forest management.

Growth and Yield of Trees and Stands

Much of the early work in Newfoundland was concerned with yield studies. For example, permanent sample plots were established by the pulp and paper industry at various locations on their limits about 20 years ago. Certain of these plots on Price Newfoundland limits are being maintained and remeasurements are being made as a co-operative project with the department. Growth tables based on remeasurement at the end of the first ten years were published by R.S. van Nostrand (1964). A second remeasurement is currently underway.

During the period 1956-1961 a reconnaissance-type inventory was

carried out by the department in Labrador. The report on this work by W.C. Wilton (1964) is the only publication of its kind available and has been widely used by various government and industry groups. Another similar study by Wilton (1954) involved an appraisal of the forest resources of the Avalon Peninsula.

In addition to these studies a considerable volume of data has been collected by the department on the growth characteristics of trees and stands in central and western Newfoundland. Continuation of work in this field is contemplated over the next few years with special reference to developing management principles for second-growth stands. Such a study will incorporate much of the information on tree and stand growth already acquired and will relate mensurational data to site and topographic features. Emphasis will be placed on yield forecasting at different stand ages and under various site conditions.

Reforestation

Until recently it was assumed that natural regeneration was adequate for future requirements and artificial reforestation was considered unnecessary. However, pressures generated by the expanding industry, disastrous forest fires and devastating insect outbreaks have led to serious consideration of the need for a prompt and extensive reforestation program on the Island.

Studies on reforestation methods have emphasized direct seeding. Following the disastrous fires of 1961 the department acquired an area of burned land at North Pond on which to conduct reforestation research. A summary of studies in progress is contained in a report by J. Richardson (1967). Various techniques are being tested, involving aerial and ground application of seed, with and without site preparation. Studies have recently been expanded to include non-regenerating cut-overs. Two pieces of site-preparation equipment have been introduced to the Region: a Swedish SFI scarifier and a chain and anchor scarifier. This equipment is available for use by other forest agencies and a number of co-operative trials have been undertaken. At present, studies in direct seeding are mainly in early experimental stages and it is difficult to assess results. It appears that under certain conditions direct seeding has been quite successful, but the method has failed in other cases. The method is relatively cheap, but success is evidently dependent on a variety of factors, including condition of the seedbed, weather and competition from scrub species. Success has been limited on deep humus, while, on bare mineral soil, frost heaval and drought kill many newly established seedlings. The method is not suited to areas occupied by competing vegetation unless preceded by site preparation. Regardless of these limiting factors direct seeding may be the only practical means of reforesting extensive recently burned areas where regeneration failure is imminent.

Research on nurseries and planting methods has not developed to any appreciable extent. At present the Provincial Forest Service operates a small nursery at Mount Pearl, but production is inadequate to supply the demand. The department has developed small nurseries at North Pond and Pasadena and in the current year introduced a plastic greenhouse from

Finland. This greenhouse has been established on an area of cultivated bogland near Colinet and results from the first summer of operation appear to be promising. It is not known what effect winter conditions will have on seedlings. The objective of this trial is to produce 2-0 stock suitable for planting, thus dispensing with the additional expense and time involved in transplant beds, etc. The cultivated bog was selected for the trial because the required humidity could be maintained without the irrigation system necessary on a dry site. Plans are underway to construct two additional units in 1968 with modifications more suited to local conditions. However, these nursery developments by the department are either experimental or in support of other research projects, e.g., tree improvement, and not intended to supply material for any extensive reforestation trials.

The technique of growing seedlings in plastic capsules and open-ended tubes has been tried on a small scale. The plastic capsule reported to be highly successful in western Canada was subject to frost heaval in field trials in Newfoundland. Preliminary trials with open-ended tubes developed in Ontario and British Columbia indicate the need for site preparation to remove competing vegetation. However trials by the department have been too limited for recommendations. The Provincial Forest Service is currently conducting field trials with open-ended tubes. Because of the advantages of speedier production of stock and easier and cheaper planting there is a need for more intensive research on container methods of seedling production. However, the seedlings planted are small in size and limiting factors of drought, frost heaval and competing vegetation may seriously restrict use of this method.

It would be highly desirable for Newfoundland to intensify its efforts in nursery development and reforestation. The need for such a program is evident when we consider the extensive areas of old, non-regenerating burns in central and eastern Newfoundland, poorly regenerating cut-overs in central Newfoundland, and areas of alder and other hardwood scrub in all areas. Also there is a need for a more balanced species distribution in the predominantly balsam fir stands of western Newfoundland, which are highly vulnerable to insect attack. It is difficult to provide estimates of the sizes of areas requiring reforestation treatment but they are extensive enough to warrant a fairly large-scale program. It would be most important, at least initially, to put emphasis on the more productive sites and not become heavily committed to reforestation in areas of low productivity. The forest-land classification and inventory project should provide much of the basic information needed to identify such areas.

Additional research is required in all aspects of nursery and reforestation methods designed to develop cheap and efficient techniques for the production and planting of seedlings. It is important that mechanized methods of planting be investigated with special attention to designing or adapting equipment for use on rough terrain. Methods need to be developed for reclaiming unproductive hardwood areas either through use of herbicides or by mechanical means. Studies in site and stand dynamics should also be undertaken to determine the underlying ecological reasons for regeneration failure on black spruce cut-overs.

Afforestation

The subjects of reforestation and afforestation are covered separately because somewhat different problems are frequently involved. However much that has been said in the foregoing section will apply here.

Afforestation in Newfoundland, with particular reference to the barren lands, has had a relatively long history. The first extensive undertaking in plantation trials was initiated about 25 years ago by the Newfoundland government when several large-scale pine plantations were established in eastern Newfoundland. H.S. Lewis (1954) concluded that a number of the plantations had failed because of extreme exposure to wind. Later it was determined that they were doomed to failure in any case by a native forest insect, a root collar weevil, especially injurious to pines on damp sites. A report on this subject was prepared by G.L. Warren (1964).

In 1966 the department introduced a forestry plough used for bogland and barren-land ploughing in Great Britain, and in 1967 the province purchased another model for barren-land ploughing alone. Ploughing of barren land is considered a prerequisite to planting. In the last two years several trial plantations of mainly black spruce have been established on the Avalon Peninsula.

Considering the problem of exposure and early plantation failure on the barren lands it would appear inadvisable for Newfoundland to undertake a heavy immediate commitment to barren-land afforestation. It is an area of forestry to be approached cautiously, on a trial basis, utilizing the better sites in favoured topographic areas. Nevertheless, research is required on problems of exposure, species selection, effectiveness of shelterbelts, etc. It might be noted that reports of visitors indicate that in the British Isles the afforestation of apparently similar areas has been quite successful.

Bogland afforestation is relatively new in Newfoundland but has received considerable attention in the past two or three years. Interest has been stimulated by developments in European countries where great strides have been made in utilization of organic soils. For example, Finland has reclaimed 2.5 million acres of bogland for forestry purposes. Newfoundland has over 4 million acres of bogland, and evidence suggests a high degree of similarity between Finnish and Newfoundland bogs.

In 1966 Bowaters employed J.A.B. MacDonald, a retired British forester, to establish a small trial plantation of about four acres on a bog in western Newfoundland. Another plantation of about 50 acres was established by the province in eastern Newfoundland. The department co-operated in both trials. An additional 30 acres was to be reclaimed by Bowaters in 1967. The approach taken in these trials has been *ad hoc*, without any basic appraisal of the suitability of the bogs for forestry purposes.

The department retained Prof. L. Heikurainen, Department of Peatland Forestry, University of Helsinki, to carry out a survey of Newfoundland bogs in 1967. Heikurainen is a world-recognized scientist in

this field and has played a leading role in developing peatland forestry in Finland. He was asked to provide the basis for a classification of peatland for forestry purposes to determine the important problems of peatland forestry and assess the forestry potential of Newfoundland bogs. He also agreed to assist in establishing practical experiments in bogland forestry in 1968.

Bogland afforestation also demands a cautious approach. Virtually nothing is known about the potential of Newfoundland bogs for forestry use or of the subsequent problems to be encountered. However, studies on bogland for agricultural use indicate a high level of success. Research in various aspects of bog ecology including the development of a method of classification and studies on nutrient status of boglands, supported by plantation trials, should be initiated immediately. However, a large-scale program of bogland afforestation should be avoided until more knowledge becomes available.

Tree Improvement

Research directed toward the improvement of forest trees, provenance testing and trials of exotic species is recognized as a most promising approach to increasing the efficiency of timber production and improving quality. Such studies are very long term. Investigations are currently being conducted on a detailed analysis of variation in black spruce to determine the degree of inherent variation in important traits and to develop hybridization and breeding schemes for improving these traits. The ultimate objective of the tree-improvement study will be to produce seed orchards of high quality stock. It might be important to note that seed supply is an important aspect of reforestation. Seed from poor parent stock is likely to produce equally poor progeny. A wide variety of exotic species is being tested in eastern, central and western Newfoundland. A major provenance trial is in progress involving 28 provenances of sitka spruce. Preliminary trials have suggested that this species is particularly well adapted to Newfoundland climatic conditions on selected sites.

Prescribed Burning

This subject has had a rather turbulent history in Newfoundland. Strong recommendations were made as early as 1953 by the late Finn Frost, Chief Forester for the province, for prescribed burning as a method for changing species composition from balsam fir to black spruce in aphid-infested areas. It was not until the fall of 1964 that prescribed burns were undertaken by the pulp and paper companies, and in the summers of 1965 and 1966 by the department. Evidence indicates that in western Newfoundland prescribed burns alone are unable to provide seedbed conditions suitable for spruce regeneration by natural or artificial seeding. Humus depth varies from four to eight inches in such areas and depth of burns was rarely more than two inches. Seedbed preparation by scarification followed by seeding or planting is required. However, burning of slash and advance balsam fir reproduction is a prerequisite to scarification and artificial regeneration of such areas.

In the spring of 1967 a co-operative project between Bowaters and the department involved burning about 30 acres in the Gander area in an attempt to find a solution to the problem of regeneration failure on black spruce cut-overs. Burning was followed by two methods of scarification and direct seeding treatments. Results of the trial will not be available for a year or two.

Thinning Experiments

Large-scale cutting experiments were undertaken co-operatively with the pulp and paper companies in 1954 and 1955, in stands of black spruce in central Newfoundland and in balsam fir in the west. These were designed to remove an economic quantity of commercial pulpwood from young stands by selection without reducing the volume per acre available at maturity. Several small thinning experiments have been established elsewhere.

It is difficult to forecast the future of research in this field in view of developments in mechanized logging and its emphasis on clear-cutting at rotation age. Manipulation of stand density by thinning would perhaps have economic application in special management areas close to industrial centres. Possibly some research should be conducted to determine the effect of thinning young dense stands to improve spacing.

Fertilization

Both industry and the province are greatly interested in possibilities for fertilization to increase growth rates. Studies in Europe and in North America have shown that forest productivity can be improved substantially and at economic levels by the application of fertilizers. However, some questions need to be answered before large-scale applications are undertaken. Very little is known about the forest soils of Newfoundland but on the basis of the knowledge available there is a suggestion that on certain sites such elements as phosphorus, potassium and magnesium may be limiting factors, especially the latter. If such is the case then the application of nitrogen alone, following the European formula as has been strongly suggested, would be largely ineffective. Studies by the department, industry and the province are either being undertaken or are in the planning stage. The department has established two carefully designed factorial experiments to test growth responses to various combinations and dosages of fertilizers, one in a balsam fir stand and one in black spruce, and several trials of an *ad hoc* nature. These studies will be expanded and supplemented by soil and foliar analyses and greenhouse experiments. Some of this work is being done co-operatively with industry. Immediate interest is oriented toward increasing growth rates in stands approaching maturity, and in pole-sized, dense spruce stands that are uneconomical to harvest. Fertilizer application may also have an important place in inducing early dominance in thicket-like stands of regeneration and will be investigated. It is anticipated that in three to four years available information will permit large-scale trials on which to base cost-benefit analyses.

Studies on forest-fertilization will be given a high priority in future work and will be supplemented by research to determine nutrient requirements of various species and analyses of the nutrient status of forest soils as well as studies in wood technology to determine the effect of fertilizers on the structural characteristics of trees. Fertilization may have application not only in increasing tree growth and improving stand densities but there is evidence to suggest it may be beneficial in correcting problems of regeneration failure on certain sites.

Soils and Sites Research

Site evaluation studies are becoming increasingly important in providing the background information required in the management of forest stands. Forest management is rapidly becoming a kind of land management. Knowledge of soils and sites and of the proper species best adapted to such sites, of the dynamic processes associated with changes in forest cover, fires, etc. is becoming a prerequisite to investment decisions on cultural practices, reforestation and other programs. Also of importance is a knowledge of what the land can accommodate in terms of other uses, e.g., wildlife and recreation.

In past years considerable emphasis was placed on studies of site ecology, and work by A.W.H. Damman has had direct application in providing methods for the land capability project now being conducted by the province.

Current studies by the department include research into the dynamics of forest sites to determine fertility changes following fire or under conditions where sites are occupied by heavy concentrations of *Kalmia*. A new project was initiated in 1967 to provide a detailed analysis of some of the better forest soils in the Island to determine nutrient status in relation to morphology, moisture levels, slope, etc. The soils being studied comprise about 50 per cent of the productive forest soils of Newfoundland. Considerable discussion centred around whether poor or good soils should receive priority in such work. The better soils were given priority because there is evidence to suggest that returns from fertilization and reforestation are higher on better sites.

A pilot-scale land-classification project is also being conducted in western Newfoundland incorporating a number of specialists including a pedologist, a geomorphologist, an ecologist, a wildlife biologist, a recreationist, a hydrologist and a forester. Primarily the project was designed for research on techniques and to improve the system of land-use classification. The study will provide a basic background of the physical resource of the land for further research on the management of second-growth stands to be initiated in 1968. The area involved is within a 50-mile radius of the Corner Brook mill and has been designated as a forest-management area by Bowaters. Discipline specialists were seconded to the pilot-scale land-classification project from other agencies, a geomorphologist and a hydrologist from the Department of Energy, Mines and Resources, and a wildlife biologist from the Provincial Wildlife Service. It is hoped that similar arrangements can be made for future

studies of this nature because it will be difficult for the Department of Forestry to support certain of these specialists. It is desirable to expand studies in this field to devise and refine methods of classification and to provide a more detailed picture of the physical resources of the land.

Plans are now being formulated for initiating studies in Labrador to establish a background of information for use by the Provincial Land Inventory section. It is anticipated that initially these studies may not extend beyond consideration of fairly broad geomorphological groupings.

Forest Insects and Diseases

Research on forest insects and diseases is considered jointly because in its development in Newfoundland both problem areas have been closely integrated and oriented primarily to the balsam woolly aphid. The forest insect and disease survey has the primary function of obtaining information on the distribution of forest insects and diseases, to assess hazard potential, and to forecast outbreaks and determine losses from injurious species. Possibly the most convenient way to discuss these closely integrated groups is under headings of the principal forest pests.

The Balsam Woolly Aphid

The aphid is an introduced species which was discovered in Newfoundland in 1949 in two separate areas, one on the west coast, the other on the Avalon Peninsula near St. John's. The western infestation presumably originated as an introduction from Nova Scotia about 1930 and the one in eastern Newfoundland is thought to be a much earlier direct introduction from Europe. The aphid now occurs in most balsam fir stands in the province except the Northern Peninsula. A comprehensive account of its distribution and damage is contained in a recent report by G.L. Warren (1967) and other ancillary information is to be issued in reports by S.G. Cochran (1967) and H.O. Schooley (1967). In view of the completeness of information in these reports it is unnecessary to elaborate further on the dispersal and damage patterns of the insect.

Other research on the aphid has emphasized biological and chemical control, the development of sampling techniques, the relationship between population intensity and damage, and appraisal of its present and potential impact on forest stands. Initial emphasis was placed on a biological control program involving the introduction of a number of species of aphid predators from Europe and Asia and has been reported by J. Carter (1966). It was evident early in the study that the effectiveness of control measures could not be assessed without a reliable method for measuring population levels of the aphid. The problem was difficult because of the microscopic size of the insect and its habit of feeding in concealed locations on the tree. A sampling method has recently been developed by D.G. Bryant and is being tested. Future studies will be directed toward determining the impact of various control factors, e.g., predators, native and introduced, weather, and condition of the host tree.

An understanding of the dynamics of populations should enable forecasts to be made when high aphid numbers and severe damage can be expected, and to facilitate an accurate assessment of applied control measures.

Studies on the chemical control of the balsam woolly aphid have been conducted for the past four years as a co-operative project with the department's Chemical Control Institute. Such studies have included testing a large number of systemic insecticides. Three of the more promising insecticides, Diazinon, Niagara 10242 and Dursban, caused aphid mortality from 85 to 87 per cent in 1967 tests and larger scale trials are being contemplated for next year. At present it is difficult to forecast the part insecticides will play in balsam woolly aphid control. If a successful insecticide can be obtained it may have an important place in controlling spot infestations. Also, with a better understanding of the dynamics of aphid populations and if periods of high numbers can be forecast, insecticides may have possibilities during these periods over extensive areas.

Other investigations in entomology and pathology are directed toward determining aphid impact on forest stands, including an assessment of volume loss from reduced growth, and the rate of pathological deterioration of dead and damaged trees. Current information suggests that reduction in growth may be relatively low but pathological deterioration in severely infested stands ranges from 30 to 60 per cent.

The Hemlock Looper

The hemlock looper has been an important forest pest in Newfoundland for many years. Outbreaks have been reported from widely separated parts of the Island and in most cases mortality of balsam fir has been high. All severe outbreaks originate in stands of mature and overmature balsam fir. A detailed review of the insect is contained in an article by W.J. Carroll (1954) which includes information on its biology and history of outbreaks up to 1953. Since 1953 small isolated outbreaks have been reported, one in central Newfoundland and a few along the St. Barbe coast. Currently a severe outbreak is in progress in west Newfoundland in the area infested by balsam woolly aphid, involving over 1,000,000 cords of mature balsam fir, and outbreaks are developing in balsam fir stands of central Newfoundland. Up to 1964 it was estimated that the average annual mortality from looper attack was 50,000 cords. The current outbreak will likely increase this amount. A preliminary report on the outbreak in western Newfoundland was prepared by G.L. Warren (1967). A detailed assessment of outbreaks, including aerial and ground surveys, was undertaken in 1967 to determine severity and extent of the damage and to provide data on which to base infestation forecasts.

Root Collar Weevils

The forest insect and disease survey has recorded damage caused by two species of root collar weevils on spruces, pines and larch throughout Newfoundland. The greatest incidence of damage occurs on all species of pine in plantations and on black spruce in natural stands. The effects

of weeviling in some of the early pine plantations has already been noted, and it is very doubtful if any of the plantations will survive to produce a crop of mature trees. Weeviling is important in natural stands of spruce, not because it causes serious tree mortality, but because of its damage to root systems through which root and butt rots are introduced, increasing the cull factor in such stands.

The problem is noted here because it will probably become much more serious as reforestation programs emphasizing spruce species are developed. In view of past experience it would be most inadvisable to establish pine plantations on any large scale. Research on chemical and cultural methods of control of this species is urgently required. The development of economical methods of controlling root collar weevils may well be a prerequisite to the success of reforestation, especially on damp sites. There may be some justification for emphasizing trials of selected hardwood species in the more susceptible areas.

Other Forest Insects

A number of other forest insect pests occur in Newfoundland, some of which reach outbreak numbers periodically. Fairly detailed annual accounts of these species are contained in annual reports of the Newfoundland Forest Protection Association. Species of importance on softwoods are the black-headed budworm, the balsam fir sawfly, and the larch sawfly. Attacks by the black-headed budworm have been mainly confined to eastern Newfoundland. Defoliation of current foliage of spruce and fir is usually severe, often resulting in fairly extensive areas of terminal shoot mortality, especially on balsam fir. The balsam fir sawfly occurs primarily in immature stands and causes some tree mortality, especially on the poorer sites. When budworm and sawfly outbreaks occur concurrently in the same stands tree mortality is much more extensive. The larch sawfly has been a serious pest of larch and an outbreak is currently in progress in central Newfoundland.

In an attempt to improve the control complex of the larch sawfly the forest insect and disease survey introduced the shrew, *Sorex cinereus cinereus*, to Newfoundland in 1958. A recent report by G.L. Warren (1967) provides a detailed account of the distribution, and control impact of this small mammal. The department also provided an extramural research grant for Dr. R. Bider of McGill University to conduct studies aimed at developing more effective methods of sampling populations and assessing biological control value.

Forest Diseases

Tree diseases are less spectacular than insects and fire but nevertheless have an equally significant impact in causing forest losses. Also, disease organisms cause rapid deterioration of trees killed or severely injured by insect attack. The estimated period for salvaging insect-killed timber is about four years and for fire-killed timber up to six years.

Studies are in progress to determine the extent and rate of fungal deterioration of balsam fir trees following attack by the aphid. Results show that decayed volume in three areas of aphid infestation in western Newfoundland was as high as 45, 50 and 60 per cent of the merchantable volume. The most severe damage in the current hemlock looper infestation occurs in these aphid-infested areas. Examination of trees dead for one year or less showed 20 per cent of the merchantable volume to be discoloured but the amount of saprot was negligible. In a decay analysis of living balsam fir in two aphid-free areas of western Newfoundland by A.G. Davidson in 1953 decay volume ranged only from 3.2 to 6.5 per cent of the merchantable volume.

The laboratory is also co-operating with the Provincial Forest Service in providing assistance in field work, in developing methods and in identifying causal organisms in the forest-inventory cull study. The study will yield a cull factor meeting local industry specifications and will also detail total decay volume and causal organisms of decay in Newfoundland forest tree species.

Fire Research

Fire protection is currently the most important activity of the Provincial Forest Service. An efficient fire-control organization has been developed and in a meeting of the Research Advisory Committee it was listed as having the highest priority on the Forest Service list. However, except for some preliminary work in prescribed burning, mainly as a sylvicultural control measure against the balsam woolly aphid, fire research has not been developed because of unavailability of staff. It has also been difficult to determine the direction fire research studies should take.

Areas of immediate interest in fire research are suggested tentatively as follows: research on the improvement of hazard-forecasting techniques, and fire-behaviour studies in relation to fuel type, topography and weather. Many aspects of fire-suppression research involving the development and testing of equipment, which are of interest to all regions should be undertaken by the Fire Research Institute at Ottawa.

Forest Economics Research

Forest economics has almost unlimited possibilities for research but has unfortunately been slow in developing, mainly because of the unavailability of qualified men. However, some progress in recruitment of forestry economists is being made, and greater use of contract research in this field is being explored.

It is difficult to define specific problems and assign priorities but it is becoming increasingly evident that economics research includes every aspect of forestry ranging from land-use decisions to the economic comparisons of various logging practices. In practically every area investment decisions must be made, and these require economic consideration. There is a good deal of information available that a qualified

economist can adapt to specific conditions. An economist can also define the areas of a research program where modifications can make the results more applicable to user agencies.

Some suggested areas for research in Newfoundland are tentatively proposed as follows:

1. The economic impact of the balsam woolly aphid and other injurious pests which cause severe losses in predominantly balsam fir forests. The study would consider not only the losses from these pests but also cost-benefit analyses of changing the forest composition by prescribed burning, scarification and planting.

2. The economics of various cultural practices, e.g., thinning, fertilizing, etc., to determine the cost of growing wood under an operational plan where intensive management can be exercised in areas relatively close to the industrial centre.

3. The economics of bogland forestry, recognizing the fact that over 4,000 square miles of Newfoundland is composed of organic soils which may have multiple uses, e.g., agricultural development and peat extraction as well as forestry.

4. The economics of the utilization of hardwoods in Newfoundland.

5. The feasibility of growing hardwoods, e.g., poplar, for use by the paper industry.

An important point for consideration in the economics of forestry is the provision of opportunities for employing underemployed and unemployed, and relatively unskilled labour. For example, reforestation, thinning, pruning, nursery work are areas where for social reasons it may be important to create employment opportunities in localities where there is a surplus of unskilled labour and welfare payments are high.

These are but a few of the promising avenues for research in this vast field, with many implications including those of a political and social nature.

Forest Products Research

It has been difficult to determine the department's role in forest products research in Newfoundland. The industry is oriented to pulp and paper manufacturing which relies on the Pulp and Paper Research Institute to solve many of its production and manufacturing problems. Both companies have developed strong applied-research sections within their manufacturing complex. The milling, plywood and related industries are relatively weak.

There appear to be two specific areas where the department can make a valuable contribution: one in establishing a close liaison with the smaller industries, and the other in wood quality studies requiring a

wood technologist. Consideration is currently being given to recruiting a forest-products liaison officer, with responsibility for maintaining close contact with sawmilling groups, for the purpose of instructing local operators in such problems as logging and sawmilling efficiency, lumber seasoning, log and lumber grading, etc. A wood technologist will be required to conduct wood quality studies, and recruitment of such a man will have a high priority in about two years. Studies on wood structure will be important as cultural practices develop in sylviculture and as exotic species become more important in Newfoundland forestry.

It should be noted here that a regrettable feature of industrial development in Newfoundland forestry is its single-commodity exploitation. Throughout Newfoundland useful timber is being left in the forest, e.g., hardwoods, because it is not adapted to the purpose of the operators. Any proposed industrial development should give careful consideration to this fact and any attempt to utilize species of no commercial value at present would be most beneficial to the province. For example, birch - which forms a high percentage of the forests of Newfoundland - has been and is probably still imported for manufacturing purposes. Also, it would appear that much of the timber extracted is being put to uses lower than its intrinsic qualities merit, and this aspect of current exploitation should receive economic investigation.

More consideration should be given to the utilization of hardwoods. Observations by the department suggest that on selected sites it may be possible to obtain three rotations of poplar to one of balsam fir. Also hardwoods may present insect and disease problems less difficult to control than the softwood species. This is not a recommendation to orient Newfoundland forestry exclusively to hardwoods but a suggestion that greater diversification in growing trees and in their exploitation would permit more efficient use of the land and provide greater benefits to the Newfoundland economy.

THE FOREST INVENTORY - LAND CAPABILITY PROJECT

One of the most progressive steps ever undertaken in Newfoundland Forestry is the Forest Inventory - Land Capability study currently in progress. For reasons of effective management and utilization, it is important that the provincial government have an adequate knowledge of the forest and land resources, the amounts available, its distribution and the potential for increased production. No prospectus for investment in forest industries can be prepared without this kind of information. Unless governments have their own data on the status of a resource, they are in no position to weigh the pros and cons of various projects and pronounce on their validity. The following is a brief synopsis of the inventory.

An agreement was negotiated in 1964, on a cost-sharing basis, between the Governments of Canada and Newfoundland. The province agreed to carry out a complete forest inventory of Newfoundland and Labrador during an eight-year period, while the federal government agreed to contribute 90 per cent of the cost. It was further agreed that the forestry, wildlife and recreation land capability study, which began in 1963 under the

ARDA Canada Land Inventory, should now become part of the new agreement to be known as the Forest Inventory - Land Capability Agreement.

The inventory plan was designed in conjunction with the Forest Management Institute of the Department of Forestry. It is a global inventory concept, suitable for large areas, which follows the double sampling method of using photo and field sampling plots as a basis for volumetric data. The Island has been divided into seven inventory regions, and within each region the merchantable forest volumes are determined by forest types for individual half-map sheets in the 1:50,000 National Topographic series. The data will be projected by different criteria and summarized by regions on electronic computers.

Two series of new aerial photographs were required for this project: one at a scale of 1:50,000 and the other at 1:15,840. The former is required primarily for land capability studies while the latter is needed for inventory. Both series were scheduled to be completed for the Island of Newfoundland in 1967.

Photo and ground sampling was completed for the Gander-Notre Dame Bay area in 1966 (Region 3), and then proceeded in the remainder of eastern Newfoundland (Regions 5 and 7). Complete inventory data for Region 3 were expected before the end of 1967.

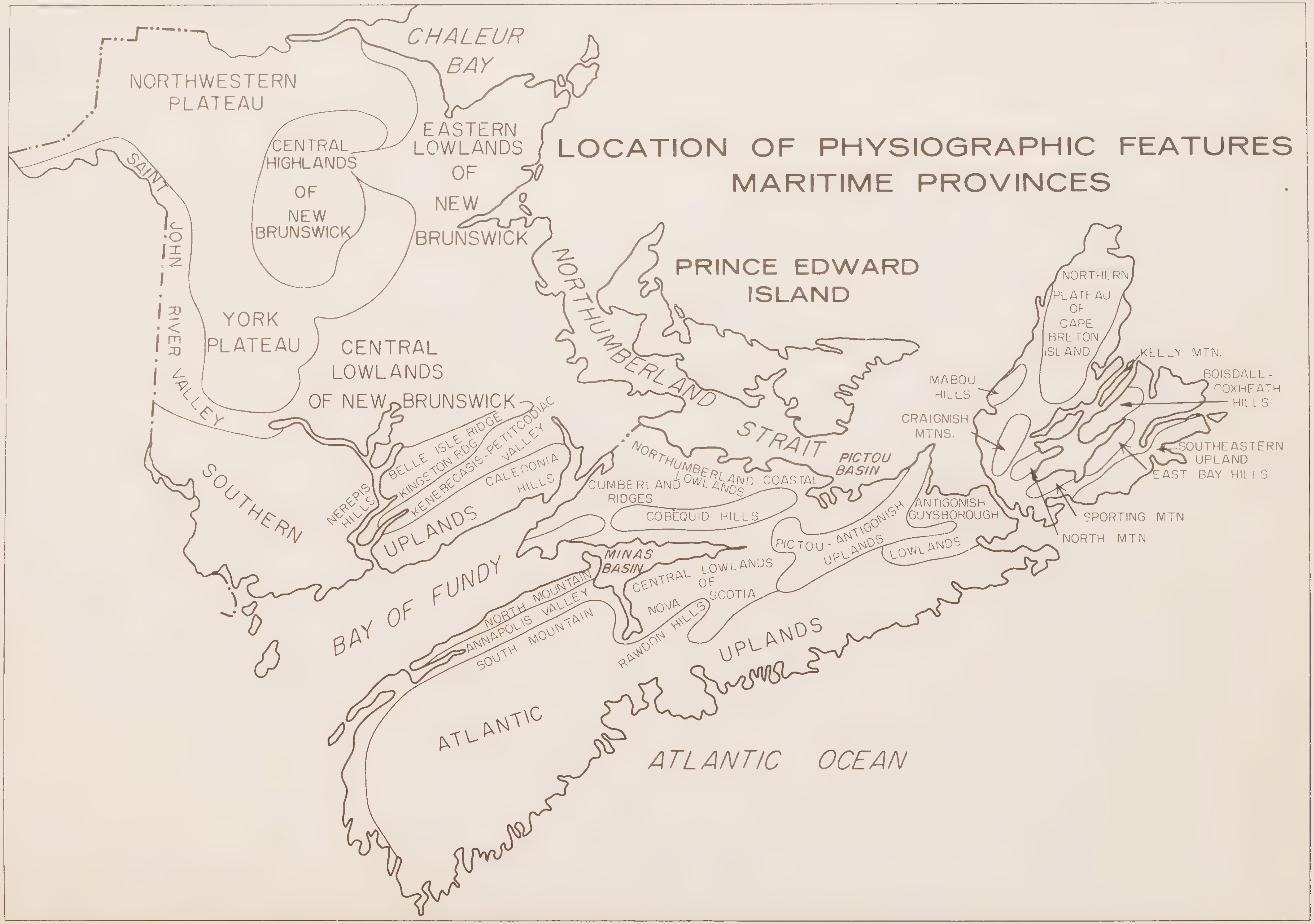
The ARDA Canada Land Inventory, which began in 1963, is a national survey to classify land according to its potential for agriculture, forests, recreation and wildlife.

Field work for the forestry land classification survey at this writing had been completed for the eastern half of Newfoundland with the exception of the Avalon and Burin peninsulas. Final maps, at a scale of 1:50,000 had been produced for about one-fifth of this area. The recreational capability study was confined to the eastern half of Newfoundland.

Background Study No 2

THE COMPETITIVE POSITION of MARITIME AGRICULTURE

ATLANTIC DEVELOPMENT BOARD



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Background Study No. 2

THE COMPETITIVE POSITION
of
MARITIME AGRICULTURE

ATLANTIC DEVELOPMENT BOARD

OTTAWA

1969

Cat. No.: TD2-½

FOREWORD

This report is the second of a series initiated by the Atlantic Development Board to examine important aspects of the economy of the Atlantic region. It was prepared as a background document for public discussion of regional development policies.

The Atlantic Development Board Act authorizes the Board to prepare "... an overall co-ordinated plan for the promotion of the economic growth of the Atlantic region". The various studies that the Board has prepared provide the basic facts on which development policies will be formulated. They are being published to contribute to public understanding and discussion of the major policy issues in the economic development of the Atlantic provinces.

The report was prepared by Dr. D. Wm. Carr of Ottawa. The author has approached his subject with full appreciation of the historical contribution of agriculture to Maritime development and with sympathetic understanding of the region's long farming tradition. But in his analysis he has carefully avoided both parochialism and sentimentality. He has sought an objective appraisal of the possibilities for profitable agricultural development, given the physical, economic and institutional environment of Maritime agriculture in the second half of the 20th century. His emphasis is on the competitive position which the Maritime farmer can achieve in the production of agricultural products.

B.H. Sonntag, associate of Dr. Carr in this study, has made a unique contribution to an understanding of the competitive position of Maritime agriculture through a series of detailed budget analyses of farm enterprises. His study, which is published separately as a technical reference volume, is summarized in this report.

No single study, of course, could examine all of the elements determining the potential for agricultural development. As Dr. Carr himself notes, further research is needed on agricultural markets and marketing before clear guidelines for future agricultural policies in the Maritimes can be formulated.

It should also be noted that the Province of Newfoundland and Labrador is not considered in this report. It was excluded because the 1955 report of the Newfoundland Royal Commission on Agriculture was considered to be still valid in all essential particulars. The Atlantic Development Board assisted in updating that study for the recently published report of the Royal Commission on the Economic State and Prospects of Newfoundland and Labrador.

Special mention should be made of the assistance provided for the enterprise analysis by W.A. West, branch manager for the Atlantic Provinces of the Farm Credit Corporation. The knowledge, experience and advice Mr. West contributed without stint has added a great deal to the confidence we can have in the dependability of the enterprise data.

The author is especially grateful to Mrs. Lucienne Frost and Miss Jean B. Jones for their skill and competence in handling the secretarial work and particularly for the numerous occasions when they cheerfully worked additional hours and on holidays so that the project could be expedited.

Ottawa
November, 1968

D.W. CARR

CONTENTS

THE COMPETITIVE POSITION OF MARITIME AGRICULTURE

1. INTRODUCTION

The broad objective of this study is to appraise the potential for agriculture in the Maritime provinces. Agriculture has been a basic industry in the Maritime provinces since at least the early 19th century. It was expanded after about 1850 to fill the gaps left in the economy by the decline of shipbuilding and the carrying trade. Like fishing and mining, farming in the Maritimes has in the main been an industry marked by relatively low incomes. Since the war of 1939-1945, Maritime agriculture has been declining generally and major problems have developed which hamper its future improvement. The solution of many of these problems requires new attitudes and new ways of thinking if the obstacles to progress are to be removed and the agricultural potential realized.

To establish a basis for such new approaches it has been necessary to appraise the basic causes of the current difficulties in Maritime agriculture. The evidence of these problems is widespread. Such evidence is found in the low incomes of farm people; in the low value of improved farm land; in the small size of farms; in the growth of weeds, brush and forest on improved farm lands; in the lack of adoption of the new technology in farming; in the increasing abandonment of farms; and in related signs of unprofitability and decline. These signs are evidence that substantial difficulties impede the smooth adaptation and adjustment of agriculture to the new environment. Yet there are also indications that in some areas, with appropriate conditions, particular types of farming can show excellent profitability in the Maritime provinces. It is the objective of this study to examine, in comparative terms, the areas, conditions (both physical and social), types of enterprises and other considerations, as a means of appraising the potential opportunities in Maritime agriculture and as a means of laying a firm foundation for the development of new policy measures designed to stimulate agriculture to reach its full potential.

A great many programs and policies have been developed to ease and smooth the adjustment of the small-scale Maritime farmer to the postwar technological revolution that has occurred in Canadian agriculture. Yet too few programs have been set up to assist him to reach the full scale and specialization of enterprise that this technological revolution now demands. Development assistances have tended to be both too few and too small. An appraisal of comparative profitability, including scale, among competing enterprises can demonstrate the most

fruitful avenues into which Maritime farming may be directed. Such comparative profitability for Maritime agriculture must be related not only to enterprises within the region but also to competing enterprises in other regions. In recent decades the competition from other regions has been increasing in significance for Maritime farming.

Accordingly, this report will include an appraisal of the elements determining comparative profitability in agriculture. The first of these elements is the physical characteristics of the region in terms of the quality of land and climate.

The second element comprises the institutional conditions including the pattern of settlement and development. The third element includes the technological environment with particular attention to its effects on competitive status of farming in all regions of Canada. The fourth element includes the structure and organization of agriculture in each of the Maritime provinces. The fifth comprises the nature and composition of the capital and manpower available in agriculture. The sixth comprises the structure and problems of markets and marketing. The seventh element comprises an analysis of the major types of enterprises in terms of scale of inputs and outputs and of net returns to the operator.

With this foundation it is possible to examine the most suitable guidelines for developing the potential of agriculture in ways that will be most profitable and will stand the test of time. These are included in Chapter 2, which comprises a summary of the seven elements examined in the body of the report and the main conclusions flowing out of the study.

2. SUMMARY AND CONCLUSIONS

Farming in the three Maritime provinces was in a period of change and uncertainty in 1967. Certain types of farming, particularly some of the land-based enterprises, had been severely disadvantaged by the changes in the technological environment. Other types needed to be enlarged to be profitable. Traditional policies, fitted to small-scale diversified farming, were in many cases unsuitable for the new pattern of agriculture now developing. Future policy would need to be directed more toward a selective enterprise expansion if the potential of agriculture were to be developed most profitably.

This is a study designed to examine the conditions and problems in farming in New Brunswick, Nova Scotia and Prince Edward Island. Its broad objective is to appraise the comparative potential for agriculture in these three Maritime provinces and thereby to indicate what might be done in the future to develop this potential most fully. The technique of analysis is designed to show which types of enterprises are likely to be most profitable and to compare particular types between regions.

Agriculture has been viewed as a basic industry in the Maritime provinces since at least the early 19th century. It was expanded greatly in that century but has languished for most of the 20th century. Since 1950, Maritime agriculture has been declining very rapidly and it was evident in 1967 that much of it was still not well-oriented in the new technological environment.

The nature of this decline in Maritime agriculture could be likened in some respects to the decline in other areas where resources were similar, such as in eastern Ontario, the Interlake area of Manitoba and the Gaspé Peninsula. Yet the Maritime region was unlike these other areas because it retained more competitive advantage by its relative isolation and distance from competing agricultural areas. Unfortunately, this isolation advantage was often small and too frequently overestimated.

Part of the decline of Maritime agriculture has been relative, similar to the relative decline throughout Canada that has resulted from the more rapid growth of the non-farm economy. But most of the decline has been absolute, a turning away from farming because of its unprofitability and unfavourable outlook. The evidence of this unattractiveness was widespread. It was found in the low incomes of farm people; in the low values of improved farm land; in the small size of farms; in the recent growth of weed trees, brush and trash on improved farm lands; in the lack of adaptation to the new technology in farming; in the increasing abandonment of farms; in the decline of young people on farms; and in other signs of unprofitability and decline.

Yet in spite of this widespread evidence of unprofitability in Maritime farming, many larger-scale enterprises were operating efficiently and profitably in 1967 and careful research shows that more enterprises could be profitable. It shows also that there are ways of overcoming the obstacles to success now faced by many enterprises. This study is designed to examine these things. Accordingly, it provides an appraisal of the elements that determine the comparative profitability of agriculture in the Maritime provinces.

The Physical Resource Base

The physical environment for farming in the Maritimes, as in any region, determines much of its agricultural potential. The characteristics of the land as well as the air above the land are the central elements in the physical resource environment. Among these physical characteristics significant in farming potential are the various qualities of the land and the amount of each type of land. These characteristics of the land can be appraised in terms of its geology, topography, soils, drainage, stoniness, climate, vegetation and location. The appraisal of these conditions of the land should then be interpreted in terms of its use with modern technology, especially in large-scale mechanized farming.

The geology of the Maritime region is generally not particularly favourable to agriculture. The Maritimes comprise the northern end of the Appalachian mountain region and form an area of uplands and lowlands, the lowlands carved by glaciation out of the areas where softer rocks occurred. The youngest consolidated rocks of the region include red sandstone and shale as well as some volcanic rocks found on the shores of the Bay of Fundy.

An appraisal of the topography of the region shows that the land surface is relatively uneven generally in comparison with other major agricultural regions in Canada. Only a few large areas of level land with good soil and drainage remained after the ice age and most of this was in Prince Edward Island. Elsewhere much of the land suitable for farming is broken by ridges, valleys, hills and bouldery knobs that significantly reduce the area of lands suitable for large efficient field operations. All three provinces are deeply indented with bays and inlets in the coastal areas and much of the land surface in Nova Scotia and New Brunswick is dominated by bedrock. In Prince Edward Island, local relief is significant, with the flatter areas frequently being poorly drained and the steeper slopes often excessively drained and eroded.

Soils in the Maritimes are a major limitation to agriculture. The soils are mainly podzolized in character. Podzol soils are usually heavily leached, low in plant nutrients and deficient in structure. Soils, to produce abundantly, must

contain adequate amounts of the nutrients essential for plant life (particularly nitrogen, phosphorus and potassium) and have desirable texture, structure and chemical reaction (acidity). Although deficiencies in these soil qualities may be remedied by tillage, drainage, fertilizers, lime, and other techniques the basic productivity of the soil rests mainly on its natural properties. Yet soil alone is not enough. The land must also be sufficiently level, well drained, free of stones and with suitable climate, location, etc., if it is to be the basis for profitable farming today. Moreover, the land in the Maritime provinces is broken into so many small and diverse fields by ridges, valleys, poorly drained areas, and disparate parent material, that most areas are too small for effective use of large-scale equipment. Dependence of farmers on these many small areas and a wide variety of soil types and mixtures for their farm land is a major handicap. There is also a great volume of detailed work necessary for precise appraisal and classification of all the soils in the region. This also accounts for the considerable amount of work still to be done on Maritime soils for agriculture and on comparisons of Maritime soils with those in other regions. But the competition of other regions with Maritime agriculture has now become so much stronger that these kinds of soil appraisals can no longer by safely postponed.

A special survey and mapping of soils was undertaken as part of this study. It was primarily designed to assess those lands that are suitable for large-scale machine operations and to eliminate those lands that are too rough, steep, stony, poorly drained, isolated, small in area, etc., for such operations. Unfortunately, sufficient information was not available to enable the study to provide the precise soil quality identifications and other classification data necessary. It became evident that a detailed study of aerial photographs of the land area at least would be necessary to do this. The study results indicated the necessity for this kind of classification if farming is to be maintained on a profitable basis.

<u>Drainage</u> is a major problem in Maritime agriculture. The drainage of land is usually related to its topography, its internal composition, and the proximity of bedrock to the ground surface. In all three Maritime provinces the undulating topography usually provides ample slope for effective run-off of surface water from the upper slopes. Yet in Nova Scotia and New Brunswick the lower levels are frequently poorly drained because of bedrock lying close to the surface or because of impervious layers in the soil profile. In Prince Edward Island the drainage problems are much less severe due to the Island's thick mantle of glacial drift with very little bedrock near the surface.

<u>Stoniness</u> is usually frequent where bedrock lies near the surface. The cost of removing stones from farm land is high. Yet the risk of damaging valuable tillage or harvesting machines

by stones is great and repair costs have risen. Substantial areas of land in Nova Scotia and New Brunswick must be excluded from tilled cropping because of their stoniness. In Prince Edward Island, on the other hand, the land is relatively free of stones.

Climate is a major determinant of the potential for agriculture in any region. Yet certain outward manifestations of climate can mislead and in the Maritimes these have frequently led the unwary into error.

Broadly, the extremes of the continental climate in the Maritimes are moderated by the marine influences of the Atlantic environment. One result of this is a climate with a fairly long frost-free season but with a cool and fairly short growing season. It is erroneous to interpret the long frost-free season as indicating particularly favourable growing conditions for farm crops, because the cool and short growing season in the Maritimes tends to restrict both the rate and abundance of plant growth. Precipitation is usually adequate in summer, but deficiencies occur every six or seven years. Frequent fogs in spring and summer and a generally high relative humidity also distinguish the climate and limit some types of farm production. Bright sunshine is not as prevalent as in other agricultural regions in Canada. In spite of the moderating effects of the Atlantic environment on winter temperatures, the higher wind speeds in the Maritimes tend to make the wind-chill factor greater (except in Halifax) than in other farming centres like London or Calgary. All of these climatic characteristics affect the number and variety of crop plants that can be profitably grown in the region and influence the cost of feeding livestock in the open air.

Rainfall is usually adequate for plant growth in the growing season, but both rainfall and humidity are frequently excessive during the hay-curing season. Similarly, the ordinary soil and air temperatures available to plants for carrying out their growth processes are frequently relatively low, and even these low temperatures are usually not maintained over a period suitably long for farm plants and their seeds to mature adequately

Over-all, the influence of climate on the ability of Maritime agriculture to compete is substantial. The relatively short, cool and moist growing season moderates the rate and abundance of plant growth. It has a selective influence on crop production, favouring hay, pasture and forage over grain. It gives an advantage to root crops and leafy vegetables like cabbage. Grain production is less well adapted to this cool summer growing season than it is in warmer and less moist regions. High humidity together with the cool autumn weather tends to inhibit the maturing and ripening of grains. These disadvantages in maturing grain and curing hay are substantial. They give advantages in cost and quality to silage over dry hay relative to other regions. The comparative coolness of the spring and

autumn seasons reduces the rate and abundance of pasture growth and tends to reduce the length of the grazing season substantially relative to competing regions.

Moderate winter temperatures make possible the production of an excellent range of fruits when soil and slope are suitable. Yet a fairly high winter wind-chill level tends to reduce the rate of gain of livestock and increase the amount of feed required for livestock maintenance, especially outdoors. It may add to the cost of winter livestock shelter also.

The Maritime climate is favourable for the production of some crops such as potatoes and probably strawberries and some vegetables. Yet there are significant climatic disadvantages in Maritime agriculture. With agriculture in many areas of the Maritimes lying close to the lower margin of profitable production because of handicaps of soil, drainage, stoniness or topography, it may be expected that these climatic handicaps will in many cases move such areas outside the possibility of economic profitability. For those areas that remain profitable for agriculture, these climatic handicaps tend to reduce their competitive advantage.

Natural vegetation provides a first approximation to the productive potential of the land. Such growth indicates the character of the environment in terms of climate, soil and other physical factors. Natural vegetation should be a primary guide for selection of the most suitable crops in farming. Thus, natural grasslands usually indicate a potential for crops requiring only moderate rainfall such as hard wheats and drouth-resistant grasses. Natural forest lands are usually more suited to pasture, hay and feed-grain crops, but because of their podzolization they frequently have lower productive capacity than grasslands. Most of the lands in the Maritimes are in this forest land category and they are thus highly podzolized with a lower productive capability than would be the case without podzolization. Many of these forested areas were unsuited for productive farming when first settled, but they were frequently opened for farming regardless of their capability, especially just after the timber had been cleared from them. Remnants of such settlements continue to contribute to the low productivity and low incomes of Maritime farmers, particularly in Nova Scotia and New Brunswick. They also explain much of the recent rapid reversion of cleared land to forest cover in these provinces. Such areas may be expected to be more profitable in suitably organized forest farms than in tilled crop production.

Location of agricultural land is concerned not only with its physical situation in space but also with its location relative to necessary services, supplies, markets and social amenities. If an area of land is large enough and productive enough it can generate the necessary services and facilities itself. But if the land is both isolated and low in productivity high costs of production and transportation may be

accentuated by the lack of nearby services.

These location problems of small scattered areas of land that are isolated and low in productivity are found frequently in Nova Scotia and New Brunswick. In Prince Edward Island, the farm land areas are more concentrated, but isolation from services and markets will continue to be substantial until improvements in transportation over the present ferry services are completed.

In total, there are a number of locational disadvantages in agriculture in the Maritimes relative to competing regions. The major farming areas tend to be a considerable distance from major population centres and consumer markets such as Montreal and Toronto. In consequence, Maritime farmers tend to be faced with excessive distances to markets, an unsatisfactory grid of local roads, many low-volume (and thus costly) marketing facilities and other deficiencies in services or facilities. Usually the productivity of the surrounding farm land does not support more than these. In other major farming regions, rail transport has in the past provided the focus for the effective development of these supporting services. But with areas of farmed land in the Maritimes generally small and scattered in the past, railways have made less contribution to farming than in other farming regions of Canada. Rural truck transport has not developed as effectively as it has in other regions, mainly because the volumes are small, the distances are relatively long and many roads are not well suited for commercial traffic.

The Influence of the Settlement Pattern

The history of agriculture in the Maritimes shows a very difficult and troubled path. After a very slow initial growth from 1605 to 1760, agricultural settlement expanded rapidly, especially with the resettlement of the Loyalist refugees from the American Revolution. But in general the land was inadequate to support this agricultural settlement, and the foundations to support it had to be developed, partly in the fisheries, but mainly in the ability to exploit the timber-trade, shipbuilding and the carrying-trade opportunities that were then opening. These new and more profitable activities tended to discourage full-time, settled, and large scale farming, and the pattern of small farms with little capital investment and attendant marketing problems became firmly rooted.

These initial economic foundations of the Maritime economy began to be undermined or to change in the 1850's and 1860's. Shipbuilding, timber and the carrying trade (via sailing ships) weakened rapidly from the 1860's to the end of the 19th century. As they weakened, agriculture was pushed forward in the Maritime provinces to fill the gap, but the dearth of suitable land resources and the unfortunate pattern of farming were

handicaps to progress. Manufacturing and mining were also expanded in this period. This adjustment continued into the early 20th century, and with the end of the prosperity boom of 1896 to 1920 the Maritimes were struck by a recession that has to a degree persisted, except for World War II, almost to the present day.

Throughout this century of change from 1860 to 1960, agricultural policy in the Maritime provinces was expansionist, and from 1871 to 1891 the number of farms increased substantially, especially in Nova Scotia. At this time, policy was directed toward using agriculture as a replacement for the industries, such as timber and the carrying trade, which were declining. Unfortunately, the resources and conditions for farming were not adequate for this role, and in all three provinces the number of farms declined. There was a tendency for farming to stabilize in the 1930's and 1940's, at least in Prince Edward Island and New Brunswick. Then, in the period after the war of 1939-1945, a major transformation occurred in agriculture in Canada, and by 1956 this transformation began to have a notable impact on farming in the Maritime provinces. This impact is demonstrated by the remarkable decline in numbers of farms from 1956 to 1966 - a drop of 32 per cent in Prince Edward Island; 55 per cent in Nova Scotia; and over 60 per cent in New Brunswick. This decline in farms occurred later in the Maritime provinces than in the other agricultural regions in Canada. But it was the same influences that caused the decline in farms in other parts of Canada. The nature of those influences, and why they impinged later on Maritime agriculture, are examined next.

Influences for Change in Canada's Postwar Agriculture

The end of the 1930's marked a notable turning-point in the history of agriculture in Canada as a whole. By the beginning of the war of 1939-1945, major new influences were at work changing the pattern of farming in Canada. Eventually, these new influences were to have far-reaching effects on agriculture in the Atlantic provinces.

Farming in the Maritimes in its first two centuries has adapted itself to some extent to the resources of the region and to the economic and technical environment of traditional farming. In the period following the war of 1939-1945 the resources were unchanged, but technology was revolutionized. Many of the resulting changes have tended to place the traditional small-scale farm in the Maritimes at an increasing disadvantage while giving substantial advantages to larger-scale farm enterprises.

The changes in the agricultural environment in Canada were of two kinds. One was an improvement in the economic

environment which resulted in higher and more stable prices and a reduction of other farm risks. The other was a remarkably rapid advance in farm technology. On the one hand, significant improvements were made in reducing the traditional high risks of farming by government measures to reduce the uncertainties of yields and prices (Prairie Farm Rehabilitation Act, Prairie Farm Assistance Act, Canadian Wheat Board, commodity agreements, price support, etc.). On the other hand, there was a remarkable improvement in the certainty of yields contributed by the new technology itself, including such factors as mechanization, fertilizers and pesticides. Coming together, these two influences brought about a major revolution in Canada's agriculture in the two decades after the Second World War. These influences not only reduced risks, they stabilized farm incomes and generally supported an environment favourable for positive improvement and adjustment to the new conditions.

Yet while the environment became favourable for change, the transformation of farming into larger and more profitable enterprises required a major re-allocation of agricultural resources. Fortunately other influences were at work to make this possible. One of these influences was the low farm incomes which made higher incomes in other employment attractive. A second influence was the sharp postwar increase in jobs in other industries which drew off farm families, especially in the Prairies, Ontario and Québec, and released much land for those who remained to consolidate into larger farm enterprises. Yet contrary to economic theory, it was not always the lowest-income farmers who moved to other employment. Rather it was those who had both a strong urge to improve their position and the necessary funds to finance both the move and the resultant waiting for suitable employment.

A third influence facilitating the transformation of agriculture was the special financial resources available in the immediate postwar period to stimulate the adjustment. The accumulated savings built up by the forced savings programs during the war provided many farmers with a reserve of cash financing. High farm incomes in the immediate postwar period, especially in the Prairies and Ontario, provided additional capital. A third source was the extensive public financing made available by the Veterans Land Act, under which over $120 million was supplied from 1945 to 1950. In the late 1950's, the Farm Credit Corporation also began an additional major expansion of credit.

A fourth influence supporting the transformation of farming was a basic change in the demand for farm products. Higher consumer incomes had shifted demand away from the starchy foods (cereals, potatoes, etc.) toward the higher protein foods, like beef, and toward fruits and green and leafy vegetables. In addition there was a growing insistence by chain retailers that, not only should the quality of food products be consistently high, but the supply should also be stabilized, with

seasonal and other fluctuations eliminated as far as possible. This new demand was related to the growing evidence that large-scale efficient enterprises could produce, more consistently, a high quality product; that they could maintain year-round production of high quality products in the case of fed beef cattle, hogs, broilers, etc.; and that they could adapt most readily to changes in demand as they occurred. Moreover, it had also become increasingly evident that farm products supplied by a great many small-scale farmers were usually very uneven and undependable in quality, were undependable and highly seasonal in volume, and were virtually impossible to improve in either quality or quantity. The result was that chain food stores began to shift away from buying from small farmers and sought to buy from larger-scale producers where quality and volume were more satisfactory. This in turn has stimulated the development of large-scale farm enterprises which can utilize the best technology and technical advice to provide the kind, quality and quantity of food products that consumers now demand.

In summary, the new environment in which farmers found themselves after the Second World War encouraged them to take advantage of the adjustment opportunities it offered. The public measures instituted to reduce the uncertainties of yield and price had moderated the risks to farmers of expanding their operations. Low farm incomes and attractive off-farm employment encouraged the release of the land needed for expansion. From several sources temporary flows of financial resources fortuitously coincided in the immediate postwar period to provide the means for the transformation. Changes in demand and the high cost of hired labour offered special profit inducements for those who could shift to larger-scale, lower-cost, mechanized operations. This was a most favourable environment for farmers who could adjust to the larger-scale operations and many farmers moved rapidly forward with expansion improvements.

The use of improved tractor power and electric motors increased greatly in this postwar period. Improved and larger-capacity tillage and harvesting equipment was added. The feeding and handling of dairy and beef cattle, hogs and poultry were mechanized and improved. Use of fertilizers, herbicides and other pesticides increased sharply. The use of antibiotics, hormones, vitamins and balanced nutrition expanded rapidly, reducing the risks and increasing the yields in livestock and poultry feeding. Labour and capital requirements per unit of output were greatly reduced, but total capital requirements per farm increased sharply. Labour per farm continued to fall even though the farms tended to become larger.

In Canada, the number of farms decreased. The average size of farm increased. In the Prairies little land was abandoned, so the decline in numbers of farms was offset by the increase in their size. In central and eastern Canada the decline in numbers was not offset by the increase in size, indicating that some of the land was completely abandoned. The result was a quite remarkable shift of farming from the Atlantic

and central Canada regions to the Prairies.

The total farm labour force declined sharply and the productivity of labour increased very greatly. In the two decades 1946 to 1966, the output per person employed in agriculture in Canada increased almost threefold. Output per man-hour in agriculture similarly increased more than threefold. These may be compared with the non-agricultural industries in which output per person increased by only 60 per cent in the same period and output per man-hour only 81 per cent.

Yet gains from this technical transformation were not evenly distributed. For example, the mechanization of crop production was most profitable where land areas were relatively large, level and free of stones. Much of the new technology (pesticides, fertilizers, etc.), was economically justified only on these better-quality soils where yields would be sufficiently increased to make it profitable. Thus, the technological improvements in agriculture, because they could be most profitably applied on the higher-quality soils and on the larger-scale farms, have notably increased the advantages of such farms over those with poor soils and small size. The outcome of this has been that profitable crop production has been increased and intensified mainly in the regions with better farmlands. At the same time, much of the poorer quality, rougher land has been virtually excluded from profitable crop production by the new conditions. Many of these poorer farms are now in the process of abandonment, as far as cropping is concerned, in both eastern and central Canada and, to a lesser extent, in the Prairie provinces. Many of these farms lie in the rough and less fertile lands along the fringe of the Canadian Shield, between the margin of arable farming on the one side and the forest margin on the other. The Maritime provinces have much of this type of land. Farming on these lower-grade lands has been passing through a difficult stage of land-use adjustment in the past decade or two. Farms in these areas tend to remain small. In numbers, these small farms comprise the majority of Canada's farms.

Thus, there has been an increasing tendency for farming in Canada to be divided into two distinct kinds of farms. On the one hand, the biggest share of Canada's farm production was being produced by the increasing number of large-scale farms. These comprised probably less than 30 per cent of the total number of farms but produced 70 per cent or more of the total farm output. On the other hand, a great many farms remained small, comprising about 70 per cent of the farms but producing only a small part of the output. The disparities in incomes, education and amenities between these two groups of farmers was widening as technological improvement and farm consolidation advanced.

Impact of the New Environment on Maritime Agriculture

The impact of the new technological environment on agriculture has been different in nature and timing in the Maritimes than in other major farming regions. The impact on Canada's postwar farming as a whole has been noted. The same influences operated in the Maritimes, but their effects were frequently delayed or different because of the particular conditions involved.

Thus the general improvement in the economic environment of Canada's farming that resulted from public measures to raise and stabilize farm prices and to reduce farm risks and uncertainties offered fewer immediate benefits in the Maritimes, although eventual benefits might be as great there as elsewhere. This was because the output of most Maritime farm enterprises was so small and diversified that a small increase in the level or stability of prices seldom gave a significant increase in income. Only for large-scale operations could these measures to support prices and reduce other uncertainties be of substantial benefit. Only to the extent that farm enterprises could be expanded to a more efficient scale, with the new technology, could these measures benefit Maritime farmers significantly. But economic, institutional and physical obstacles prevented or delayed such a shift to larger-scale operations in the Maritimes.

In other regions, low farm incomes made the higher incomes in other employment attractive, and a sharp postwar increase in urban job opportunities was thus able to draw farm families off the land, releasing the land for consolidation into larger-scale farms. In the Maritimes, the lack of attractive new alternative employment was a major obstacle to a postwar reallocation of land resources. Moreover, while low farm incomes in the Maritimes were a strong inducement to move to other employment, the income alternatives in other established Maritime industries, like fishing, mining, woodswork, etc., were equally unattractive.

In other regions, special financial resources were available to farmers to facilitate the adjustment to the new technological environment. Similar resources were available to Maritime farmers, but the farms were too small to provide adequate basic security and there was clearly a greater aversion there to borrowing and to incurring debts for farm expansion.

In other regions, there was a basic change in demand which gave advantages to larger-scale enterprises because they could provide more dependable qualities and quantities of farm products. This basic change in demand has offered benefits in the Maritimes as great as or greater than in other regions. It is particularly applicable to production of fresh and frozen vegetables, to potatoes, eggs, poultry, beef feeding and hog feeding. It is in some of these types of enterprises, which require little land, that the major opportunities for agricul-

tural development may lie. It is in just such enterprises that the Maritime provinces, in recent years, have been exploiting these changes in demand which have given them positive advantages in such products as frozen vegetables and potatoes.

In other regions, major improvements in yields, costs and certainty were offered by the new technology, including mechanization, fertilizers, pesticides and feed ingredients. In the Maritimes, the benefits from such technological improvement were frequently smaller and usually applicable to a narrower range of enterprises. Thus, for crop farming, the opportunities for using the new technology were limited by the available land that was suitable for large-scale machine operations. For forage-feeding enterprises, the deficiencies in the natural fertility of the soil and the costs of remedying them were a major handicap. In beef, hog and poultry feeding enterprises the lack of proximity to major consumer markets, like Montreal or Toronto, or to sources of low cost feed grain, like Alberta, were handicaps to rapid and widespread adoption of the new technology.

It may be evident that in the Maritimes these handicaps substantially delayed the adoption of the new technology and the adjustments they implied. They were held back further by the established ways of doing things in Maritime agriculture - traditional methods and procedures, patterns of land holdings and policies encouraging people to remain on the land.

The resultant delays in adjustment to the new technological environment have permitted other disadvantages to accumulate. As the technological revolution advanced in more favoured regions, it tended to undermine the competitive capacity of established Maritime agriculture. The most serious evidence of these disadvantages is that the income position of Maritime farmers deteriorated even though their farming operations remained relatively unchanged. This deterioration is related to the more rapid improvement in other regions. Because in other regions large-scale enterprises have been developed which can most effectively use the new technology, their output per unit of input has increased remarkably and costs per unit have accordingly been lowered. As a result of these lower costs in other regions, farm product prices have not risen as much as prices of other things. The large-scale operator elsewhere has been able to make a good profit with prices little, if any, higher because of his lower costs per unit of output. What this means for the small-scale farmer, who has had little benefit from higher productivity, is that he has had a substantial increase in his costs (i.e., prices of supplies, etc.), but little increase in his selling prices. Instead of his unit costs going down, like those of the large-scale farmer, they have been going up. Instead of his net farm income staying the same because his operations and revenue were the same, it has been going down.

It is this impact of the new technology that is now impinging on Maritime agriculture. It may be expected that this impact will be much more severe and more likely to stimulate changes from now on than the earlier impact of technology was able to do. This explains why Maritime agriculture, which proved largely resistant to the initial stages of the technological revolution, was beginning to weaken rapidly in the late 1960's under this doubling of its current impact. It explains why the number of farms and the people on farms declined so rapidly from 1961 to 1966. It indicates that careful consideration must be given to the future development of agriculture if it is to be stabilized against the pressures now impinging on it.

This is a major objective of the enterprise analysis presented in Chapter 10: to appraise, for the Maritime region and for each of the provinces, the relative profitability of major farm enterprises. To appraise such enterprises satisfactorily, it would be necessary to have a great deal more information, especially on the comparative productivity of the various qualities of land in each region in terms of outputs of grains, forages, hay, silage, etc., than was available for this study. Yet in spite of this lack of productivity information, it has been possible to make some very excellent comparisons of competitive enterprises.

Population and Labour Force

Population fills two roles in the economy - it provides the labour force required to produce the goods and services as well as the families that consume them. These two roles of population are closely linked together by the level of employment, output and incomes that the population enjoys. When employment and incomes are high, the consumer population is able to spend more for things beyond the basic necessities of life. But when employment and incomes are low, they must spend a larger share of their income on the necessities (food, shelter and clothing) and at such times they usually try to provide more of their own subsistence (garden produce, fuel, and other income-in-kind). The implications of these considerations need to be examined in appraising the market for agricultural products in the Maritimes.

Population in the Maritimes is expected to grow by less than 0.7 per cent a year, about one-third the rate for Canada. Thus consumer demand is unlikely to expand very rapidly. Because the population of the Maritime provinces has continued for several decades to be more rural than the rest of Canada, it has also normally been more self-sufficient in providing its own food and other requirements than the populations of most other provinces. Income-in-kind is a higher proportion of net farm income in the Maritimes than it is in other provinces. Conversely, Maritimers tend to purchase a smaller share of their consumer requirements in the market place.

There has been more unemployment and lower incomes in the Maritimes than in the rest of Canada and these tend to lower consumer demand. Incomes in the Maritimes are lower not only because of higher unemployment but for several other reasons also - the value of output per worker is lower, the proportion of the population participating in the labour force (both male and female) tends to be lower, the level of education tends to be lower, many of those designated as employed are not fully employed and there is a higher proportion of non-producers in the population.

Thus, as a consumer market, the population of the Maritimes does not offer much potential for growth. It may be expected that population will not grow very much in the next decade at least. Yet it may be expected that incomes will increase and that people will continue to shift from rural to urban areas. These should both improve the market for farm products.

The characteristics of the labour force indicate the effectiveness of the population in its capacity of producer. Several of these characteristics were noted as reasons for the low level of incomes - the low labour-force participation rate of the population, the high unemployment rate, a relatively low level of education (except in agriculture), and a large proportion of non-producers (old and young).

The farm labour force in the Maritimes was reduced by more than two-thirds from 1941 to 1961. In Canada, it fell only 40 per cent. A further substantial decline occurred in the Maritimes from 1961 to 1966. The farm labour force was only 6 per cent of the total labour force in the Maritimes in 1961 against 10 per cent for Canada. Because of the age distribution of farm operators, it is expected that the farm labour force in the Maritimes will continue to decline at a faster rate than in the rest of Canada. But lack of competent farm managers is unlikely to be a handicap to agricultural development in the Maritimes. It is expected that the farm labour force in the Maritimes, which fell from 34,000 in 1961 to about 24,000 in 1966, will decline by an additional 5,000 to 6,000 by 1975.

Capital and Financing

The pattern of financing for agriculture has been greatly altered by the technological revolution, particularly in those farming regions where large-scale enterprises have become prevalent. The most striking change is the great increase in the total capital required for each enterprise. This increase in capital was not distributed equally for each type of enterprise. For cropping enterprises, there was usually a major increase in the capital invested in land and an increase in machinery capital per farm, but a reduction of machinery capital per acre. For enterprises requiring little land, like poultry and hog enterprises, the investment in buildings, machinery and

operating capital increased greatly. By 1967 capital investments in agricultural enterprises of \$100,000 to \$200,000 were not out of the ordinary.

In many cases these investments had been put together largely in the lifetimes of the present farmers. The financing of such enterprises had required substantial changes in traditional credit and debt patterns, with the size of farm loans greatly increased and a greater frequency of additions to mortgage debt. The new technology was moving forward so rapidly that it had become necessary for farmers to invest much more frequently in new equipment or in expanded operations as a means of using the most efficient techniques to keep abreast of competitors. The increase in cash requirements for operating expenses was also remarkable. It was related to the shift from horse and oxen power to motor power and to the great increases in cash purchases from the rest of the economy, including such items as fuels, feeds, fertilizers and pesticides.

These changes in the financial structure of farming had brought some changes in the pattern of credit. Yet as Canada approached the years when a new generation was about to take over farming[1] it was evident that some major new changes might be needed to meet future requirements. One was to make provision for financing the transfer of these high-capital enterprises from one generation to the next. Another was to provide more adequately for credit for operating capital.

In the Maritime provinces the pattern of financing has changed substantially, although not as much as in other major farming regions. The capital values of farm enterprises have increased, but most of the increase has been due to higher prices for the land. Yet, in Canada, total tangible farm assets increased by 134 per cent from 1950 to 1966, while in New Brunswick they increased by only 10 per cent, in Nova Scotia by only 18 per cent and in Prince Edward Island by only 56 per cent. On a constant-dollar basis, total farm capital has undoubtedly declined in all of the Maritime provinces in this period.

Financing of farming has become more complex and demanding. When farms were small, the traditional "agricultural ladder" could be used to gain ownership without much capital. Farming today requires very large amounts of capital. Moreover, the rapid rate of technological change requires frequent additional borrowings to keep the enterprise abreast of new competitive techniques. In addition, the amount of cash required for short-term operating capital has increased remarkably. Many farm enterprises in the Maritimes, aside from the great number of very small ones, require fairly massive doses of capital to make them competitive.

1/ There was a major changeover of farming to a new generation immediately after the war of 1939-1945. In consequence, a new generation will be taking over again in the decade centred on 1970-75.

New procedures and new levels for lending need to be established to meet these critical financing requirements in the Maritimes. Larger mortgage loans and extension of their supervision is one such need. An expansion of credit for short-term operating capital is required. Careful consideration should be given to the financing of land improvement and farm consolidation, but such financing should not be so great as to be an excessive burden on the operator. Special provision should be made for the financing of large-scale enterprises which do not require much land, and thus offer a smaller security base in fixed assets.

Structure of Markets

The Maritime provinces have long needed effective appraisals of the marketing of farm products including appraisals of marketing facilities (storage, auctions, transportation, grading stations), primary marketing agencies, wholesaling and retailing, grades and grading, buying and selling, the qualities of particular products and the markets for each, and other considerations. Usually the so-called "marketing problems" range through this whole spectrum of marketing, from the producer to the consumer.

A continuing problem in the Maritime provinces has been that local markets are mostly small and frequently widely scattered. The quality of the product suffers as a result. The relatively long distance between farms and consuming centres make it more difficult to co-ordinate the qualities and quantities that go on the market, and prices suffer accordingly. The small scale of many producers and the smallness of the total volume produced are major handicaps in marketing some Maritime farm products. The output of many small producers when combined for market is usually uneven and undependable in quality. Thus many Maritime markets have too few agencies and services and indadequate facilities because the quality is poor and the volume is too small to support more. Transportation costs tend to be high because volumes are small, roads tend to be circuitous and more suited to tourist travel than rapid commercial trucking and because trucking equipment is frequently small-scale and relatively inefficient.

Public policy for marketing remains geared to the many small-scale farmers, but most farm production today is marketed by a relatively few larger-scale producers. It is an appropriate time to adapt public marketing policies more toward the support of these large-scale farm operators. Improved markets and marketing will be needed if Maritime agriculture is to reach its greatest and most profitable potential. A number of special studies should be undertaken to appraise the marketing alternatives and market potentials for major products and enterprises in each province and in the region.

It is commonly stated that the market for Maritime farm products ought to be as great as the Maritime consumption of such products. Yet it needs to be recognized that, only to the extent that Maritime farm costs are low enough to yield a satisfactory profit at going market prices, are even the local markets open to Maritime farm products. The markets with the greatest potential are those in which Maritime farmers have the greatest competitive or profit advantage. It follows that the farm markets in the Maritimes can be called the exclusive preserve of Maritime farmers only when their costs are lower than the delivered costs of their competitors.

The potential demand for farm products in the Maritimes is influenced by the high proportion of rural-to-urban population, the low income levels and the slow growth of population. Because it may take some years for these conditions to change, the demand for farm products in the Maritimes should not be expected to expand very much for a time. Markets in other parts of Canada should continue to expand rapidly. Export markets may also grow but the outlook in these is much less certain.

It can be concluded that the marketing of agricultural products in the Maritimes, because of the nature of the physical and economic conditions there, will continue to be a source of problems. Such marketing problems seem excessively important and pressing at this time because so little has been done to analyse them adequately or even to describe them effectively.

Unfortunately, many of the so-called marketing problems are, more accurately, production problems and relate to the competitive disadvantages of the Maritime farm enterprise either in costs of production or in transportation or other such handicaps. Because markets will not yield such farmers a profitable price under these circumstances, it has been frequently suggested that they have "marketing problems".

The problems of marketing lie rather in the lack of adequate facilities, agencies and supporting services for marketing. This lack may be explained partly by the relatively small volume of many products produced for the market. It can be partly explained by the lack of understanding of the nature and solutions of marketing problems and the lack of good analytical research designed to provide that understanding.

Effective marketing research, perhaps as much as any other research, can make a major contribution to the future success of agriculture in the Maritime provinces. This is because effective marketing research can appraise all the factors, favourable and unfavourable, encountered as the product moves from the farmer to the consumer. In this way, research can provide the information to remedy the defects and to profit by the advantages. Yet market research is not of much value unless it is competently carried out. In this respect the so-called

"market research" that is concerned only with product promotion may often do more harm than good. Marketing research usually requires more thorough and comprehensive research than this to do the job properly.

Competent analytical research in farm marketing is scarce. Yet the marketing of almost every major farm product in the Maritime provinces requires this kind of careful, analytical appraisal to adapt it to the new conditions now found in farm enterprises and in consumer markets. Comprehensive analytical research, particularly in the marketing of milk, potatoes, vegetables, fruits, livestock, and some other products, will yield valuable benefits to farmers.

Particular features of marketing also require effective research. Among these are transportation services. The improvement of transportation services in the Maritimes is of critical importance for the future development of agriculture. Severe competitive disadvantages are imposed by local transportation services. Such disadvantages are not widely recognized although they are substantial in terms of circuitous and time-consuming market roads, inefficiencies of the small-scale trucking equipment in use, irregular and uncertain transport services, ferry services that impose costly delays and uncertain deliveries, and location of producing enterprises at excessive distances from markets. Many of these defects of transportation could and should be remedied by public action. In both Nova Scotia and New Brunswick, farmers are disadvantaged by the lack of direct roads to their markets. In New Brunswick, the location of the milk processing market needs reorganizing. In Nova Scotia, much hog production is located unnecessarily distant from the sources of feed and slaughtering, and from consumer markets, and these inefficiencies are supported by a subsidy to equalize the costs of transporting hogs to market.

In Prince Edward Island, the major transportation defect is in the excessive delays and uncertainties imposed on farming by the existing ferry services. The future of farming on the Island turns to a major extent on whether effective improvements to such services can be provided in the relatively near future. If they can, Prince Edward Island promises to be a major supplier of farm products for the Maritimes and other regions. If they cannot, agriculture in Prince Edward Island can be expected to depend more on non-perishables and low-valued products on which the costs of delays, uncertain deliveries and damaged produce can be minimized. This is because, under modern conditions, buyers of farm products (especially chain-store buyers) insist on prompt and regular delivery. If shipments are held up by a ferry service that can be upset by adverse weather, the buyers do not charge this against the price; they go to another supplier who can provide the continuity of service they need. This disadvantage applies particularly to those perishable processed products (vegetables, potatoes, etc.) and fluid milk in which so much of Prince Edward Island's future agricultural

potential lies. It may be concluded that unless these disadvantages of transport service to the mainland can be eliminated, the potential for agricultural development on the Island will be sharply reduced. Moreover, under these conditions, agriculture is unlikely to thrive and the low-valued land will tend to fall into low-valued uses such as for summer residences with a resultant drop in the province's production and incomes.

A valuable research contribution would be made by a fuller appraisal of the potential demand for Maritime farm products both within the Maritime provinces and outside them. In the present study it was possible only to explore the nature of the differences in demand and to suggest ways of appraising the unique characteristics of demand imposed by less urbanization, lower incomes and slower-growing population in the Maritimes than in other regions. A full appraisal of potential demand for each of the provinces is needed.

Such an appraisal of demand should include an assessment of prospective prices and indicate whether such prices may be profitable to Maritime farmers. Because Maritime farm enterprises are burdened in many cases with substantial disadvantages, their costs of production tend often to be higher than the costs of similar enterprises in competing regions and their profits correspondingly lower. This limitation needs to be more widely recognized by those concerned with agricultural development in the Maritimes.

The Relative Decline of Agriculture

The rapidity of the relative decline in Maritime farming in the decade 1956 to 1966 has been remarkable. This extraordinary rate of decrease can be explained by two influences - the more rapid rate of growth in the rest of the economy and the particular impact of the new technological environment relative to the physical, institutional and economic resources available in the Maritimes.

In the first instance, it is not extraordinary that Maritime agriculture should decline, to a degree, relative to the non-farm economy because the rest of the economy has been growing at such a rapid rate. This relative decline of agriculture has, of course, been evident not only in the Maritimes but throughout Canada, and in most other countries where industrial growth has outstripped farming. It is an outgrowth of the technological revolution with its resulting higher incomes which have increased the demand for products other than food. This relative decline of agriculture is simply the working out of the converse of Engel's law of consumption, "The poorer a family, the greater the proportion of the total outgo that must be

used for food."1/

This relative decline of agriculture may be measured in several different ways - in terms of the share of national income produced in agriculture, in the share of total labour or capital employed in agriculture, or in the relative importance of agricultural land as a source of personal income. This relative decline of farming may be expected to continue in the Maritime provinces or in any other region where the non-farm economy grows faster than farming. This has been called "the law of the declining importance of agriculture" (Johnson, 1966). The neglected aspect of this "law" is that, as economic growth progresses, the relative decline of agriculture may be at an increasing rate and will almost certainly not be at a decreasing rate. Thus it may be expected that the rate of relative decline of Maritime agriculture will increase in the future even after current adjustments have been accomplished. At the same time, a major part of this decline will be due to the more rapid growth of the rest of the economy rather than to any deficiency in the output of agriculture.2/

It may also be evident from this that a substantial part of this decline of agriculture relative to the rest of the Maritime economy, can be attributed to forces outside agriculture which are not subject directly to agricultural policy. At the same time, there has been a notable decline in Maritime agriculture relative to Canada's agriculture as well as an absolute decline in much of Maritime farming. It is these latter declines that need to be examined to appraise the future potential of farming in the Maritimes. The considerations involved in these phases of the decline of agriculture are complex and far-reaching. The economic considerations in comparative terms may be found in the nature of the physical resources available for farming in the Maritime provinces; in the pattern and institutions of settlement and agricultural policy; in the technological revolution that has occurred in Canada's agriculture; in the established structure of farming and the difficulties of modifying it; and in the problems related to incomes, population and labour, capital and credit, and marketing facilities and services.

1/ See Burk (1954). In economic terminology, Engel's law states that, as real per capita incomes rise above some minimum and very low level, the income elasticity of demand for farm products becomes less than unity, or less than one. Since the income elasticity of demand for all goods and services is unity, it follows that the income elasticity of demand for non-farm goods and services is greater than unity.

2/ This distinction is not always as clearly recognized as it should be.

The evidence indicates that the present rapid decline is likely to continue, probably for the next decade or more. The influences for change continue to be extensive and strong. The traditions and institutions which in the past have resisted change are weakening. Profitable methods of adapting the new farming technology to the particular conditions in the Maritime provinces are being more widely recognized. The demand for higher incomes continues to stimulate farmers to operate more profitable enterprises or to move to more attractive employment elsewhere. The advanced age of many farmers in 1967 meant that many would retire in the next decade, and that few young men were coming forward to replace them, especially on the smaller farms. In this way, the lands that have become ill-adapted for farming under the new technological environment will continue gradually to be withdrawn from agriculture. In a similar way, marketing traditions that are ill-suited to the new mass markets for food will gradually be replaced.

These changes in farming, though substantial, should not themselves be a cause for concern. This is not the first time in man's history that a major change in technology has shattered a rather idyllic pattern of rural living. Goldsmith's poignant "The Deserted Village" could be applied as touchingly today as it was to the similar changes of 200 years ago.

Thus, the evidence indicates a sharp decline in Maritime agriculture over the decade 1967 to 1977 and, in the course of this decline, a major redirection of farming away from the very small-scale enterprises that have been the hallmark of past farming. By the latter year, the numbers of farms and farmers may be expected to decline to probably half their level in the 1961 Census. The area of land in farms will continue to decline, particularly in New Brunswick and Nova Scotia. Conversely, farming may be expected to continue to shift toward larger-scale enterprises. This shift was well advanced by 1967 and the large enterprises, though few, were already producing more than 75 per cent of the farm products marketed.

Yet while these major adjustments were well underway in the farming industry in the Maritime provinces in 1967, difficult problems of adaptation will still be encountered in the next decade because of the obstacles to adjustment. Prices of land in the smaller farms, though depressed, were still high relative to net profitability and, accordingly, the market should not be counted upon to smooth the transition toward consolidation of farms. A substantial increase in job opportunities or in incomes, or both, would assist the mobility of rural people and the consolidation of farms.

At the same time, it should not be concluded that because Maritime agriculture has been changing and declining that its future holds little promise. There is good evidence that farming has a substantial future in the Maritime provinces. But, future farming must be satisfactorily profitable if it is to remain a strong industry.

The great lesson to be learned from all this is that Maritime farming can no longer be the rough-and-ready operation it was in the past, except for those who do not concern themselves with operating a profitable enterprise. If Maritime farming is to be maintained successfully it must be as profitable and efficient as farming elsewhere and farm employment must be as remunerative and acceptable as any alternative employment. To make it more profitable and acceptable and thereby to extend farming to its optimum in the Maritime provinces will be a major policy task for the future.

It should be noted here that this appraisal will not suggest early elimination of the numerous small farms in the Maritime provinces. This will not be suggested for several reasons. First, if sufficiently attractive alternative job opportunities become adequately available a substantial part of these small-scale farmers will move elsewhere of their own volition. If such alternative employment is not available, these people may most satisfactorily remain where they are. Secondly, a few of these small-scale farmers enjoy living on small farms of their own, perhaps less because they want high incomes than because they enjoy the independence, closeness to nature, and convenience of rural recreational opportunities. These kinds of farmers may frequently be expected to remain on their small farms, often with some off-farm jobs, even though more attractive job opportunities should open to them elsewhere. This probability, that a considerable number of small farms will remain after the major modifications of the current adjustment period have been completed, is not necessarily an undesirable outcome. These rural people can contribute much to the social progress and stability of the region provided they are not expected or encouraged to live in extremes of isolation, or to provide farm products of marketable qualities, or to expect more costly social amenities without contributing a substantial share of their additional costs.

In this context, then, although steps need to be taken to improve the profitability of farm enterprises in the Maritimes, a major effort also needs to be made to improve the alternative employment opportunities available to the small-scale, low-income farmers in these provinces.

Profitability of Enterprises

The budget analysis of the comparative profitability of farm enterprises, set out in detail in Volume Two of this report, was designed to indicate the most profitable types and scales of enterprises, with the limitation that labour inputs and social amenities should be comparable to those in other employment. Comparisons were made of enterprises within each of the Maritime provinces and of the same enterprises in each of the provinces. Comparisons were also made between enterprises in the Maritimes and those in other regions. Budget analyses were completed for 15 enterprises and partial analyses were carried out for two others.

A review of the results shows that much of the traditional small-scale farming in the Maritime provinces has little prospect for profitability. Some of the most common enterprises show only marginal profitability even at optimum scale but most of the other enterprise types when analysed at an optimum scale showed good prospects for profitability.

Potatoes, tree fruits, hogs and poultry (eggs and broilers) were the enterprises indicated to be most profitable and dependable for future development. Potatoes and tree fruits, because they had become established in competitive markets outside the Maritime region, offered possibilities for expansion greater than most enterprises.[1] Hog and poultry enterprises showed good profitability at optimum scale but their markets were confined largely to the Maritimes and they faced strong competition there from other regions.

Processing vegetables were indicated to be quite profitable although information on complete enterprises was not fully available. Viewing the long-run outlook for processed vegetables, particularly frozen products, as well as the advantages in production they enjoyed in particular areas in the Maritimes, it seems evident that special attention should be given to the potential for expansion in this field, especially in potato products, cole crops and peas.

Strawberry and blueberry enterprises showed good profitability under the conditions assumed. Yet two characteristics of these enterprises may reduce their potential over the long term. One is their dependence on the current availability of low-cost seasonal labour for picking. The other is the tendency for their markets to be uncertain because of such factors as fluctuating prices, strong export competition, variability of quality and short seasons. These characteristics make their long-run potential less favourable than their enterprise results might indicate.

Greenhouse enterprises were indicated to have a good profit potential. It would seem likely that substantial opportunities for profitable expansion are available in greenhouse production.

Tobacco enterprises are being initiated in the Maritime provinces. Their operations had not advanced far enough to provide adequate data for an enterprise analysis, but the available evidence indicated the likelihood that optimum-scale enterprises could be quite profitable and that suitable land was still reasonably priced in 1967.

1/ The effect of the devaluation of the United Kingdom pound in late 1967 on the market for tree fruit products had not become clear at the time this was written, but it would undoubtedly be adverse.

Those enterprises that were indicated to be marginal or generally unprofitable at optimum scale included some of the most common types of traditional farming - dairy farms producing milk for manufacturing purposes only, beef enterprises and feed-grain enterprises.

Yet dairy enterprises producing fluid milk at optimum scale were indicated to be satisfactorily profitable because of the higher price for fluid milk than for manufacturing milk. Beef and manufacturing milk enterprises might have some potential for profitability at optimum scale using corn silage for feed, but this requires further testing, and even though it might turn out to be profitable in the Maritimes, such an enterprise would be less profitable than similar enterprises in (say) Ontario. Feed grain as a specialized enterprise appeared to offer little potential, but in conjunction with potatoes or hogs, in appropriate areas, feed grain was indicated to have good possibilities.

Thus, the potential for profitable land-based farming must be recognized as limited mainly to a relatively few types and locations - fluid milk enterprises in the vicinity of major consuming markets; potato enterprises where land of the required quality is available; and tree fruit enterprises where soil, slope and other conditions are favourable. For many land-based enterprises - manufacturing milk, grain, beef cattle, etc. - their lower profitability relative to similar enterprises in other regions makes their outlook quite marginal and limits their long-run potential to enterprises having special local advantages.

The Potential for Maritime Agriculture

For those who are determined to cling to the old traditional ways in Maritime farming it may be evident that the economic outlook is still not bright. Yet for those who are prepared to adapt their farming to the ways of the new technological environment in order to make it most profitable, the prospects can be attractive. It is toward these latter enterprises that the Maritime provinces must turn for the future development of their agriculture. In short, if enterprises can be established now that will still be thriving and profitable enterprises by 1980, the Maritime provinces will have been well served in their agricultural development and policies. These long-run objectives will be a consideration in the following appraisal of the potential for farming in the Maritimes.

This appraisal of potential must also be qualified by the deficiencies of pertinent information. The extent of expansion of the land-based enterprises cannot be fully estimated until an adequate identification of areas and qualities of suitable land has been completed. The comparative potential profitability of all enterprises cannot be fully appraised without more information on relative productivities; on market potentials, especially export potentials; and on the practical operations of

particular enterprises in the Maritimes. Yet in spite of these deficiencies of data, it was possible to make good progress in appraising the relative profitability of Maritime enterprises. The significant features established in this overall review of Maritime agriculture have been the evidence of a continued rapid decline in traditional farming; the continuing opportunities for expansion in larger-scale enterprises; the uncertainties and difficulties facing all but a few of the land-based enterprises, even those of large scale; the significant opportunities offered by particular land-based enterprises and by many enterprises that require little land; the tendency for a larger share of Maritime farm output to be produced for the market and a smaller share for income-in-kind or home use; and an increasing tendency to adapt Maritime farming to the new technological environment.

The enterprise analysis has shown that land-based farming, with a few notable exceptions, encounters substantial handicaps in competing with other major farming regions. Yet even for the few land-based enterprises that may be profitable, the obstacles to developing an effective scale of operating unit are very great, particularly in New Brunswick and Nova Scotia. These obstacles of land-based farming should be enumerated. First, Maritime farms are mostly much too small and must be grouped together to obtain enough land for an effective scale of enterprise. But obtaining satisfactory ownership or control of many small individually-owned parcels is a costly and time-consuming task. Second, the quality and suitability of much of the land has not yet been identified precisely enough to remove the uncertainty about its productivity and best use. Third, the costs of land improvements are very high because these podzolized Maritime soils tend to be quite acid and infertile and because most such farms need costly drainage, removal of fence rows, etc., before they can be used most productively. Thus, overall, the costs, in time, organization and capital, of gaining control of enough suitable land for a satisfactory enterprise and then of liming, fertilizing, clearing, draining and otherwise preparing the land for use, become a quite excessive burden for those trying to adapt to large-scale land-based enterprises. It may be evident that with these high costs for land development, it is only the most productive lands that can be expected to be profitable. That is why it has become so important to identify more clearly the qualities and areas of land that are suitable for such enterprises in the Maritime provinces, particularly in New Brunswick and Nova Scotia.

If land-based farming is to recover from the set-back it has encountered in the last decade the most productive lands must be identified and used for such enterprises. The evidence from the budget analysis of enterprises would indicate that only the most productive crops, such as potatoes (including associated grain or forage production) and specialty crops like cole crops and other processing vegetables, can be expected to be profitable on the most productive soils in the Maritimes.

Tree fruit enterprises can be profitable on various qualities of soil but they require quite specific conditions in terms of other environmental factors including slope, drainage, freedom from frost, etc.

The enterprise analyses suggest also that, on the higher quality lands, manufacturing milk enterprises and beef enterprises might become profitable and more competitive if good success in the production and feeding of corn silage can be obtained but the possibilities for this are not yet determined in the Maritimes. On poor quality land, these enterprises should not be expected to be fully profitable even using corn silage, except where there is exceptional management and, in that case, such management would probably be underpaid.

The evidence of the enterprise analyses indicates that on land suitable only for grass, enterprises can be profitable only in the production of fluid milk or other products enjoying high enough prices to cover the higher costs of production on such land.

Land suitable for profitable land-based farm enterprises is becoming scarce in New Brunswick and Nova Scotia. Such land is more plentiful in Prince Edward Island. The enterprise analysis indicated that in the latter province, to the extent that all the higher-quality land is not required for the more profitable enterprises, such as potatoes, specialty crops, etc., it may be used, though less profitably, for grain-hog enterprises or, still less profitably, for manufacturing milk production.

Because of the handicaps now being encountered by land-based farming in the Maritimes, it would seem evident that the shift away from land-based enterprises will continue. It may be expected that the shift toward those enterprises that require little land will also continue, provided existing obstacles can be overcome. The adaptation of farming to these new conditions will require the development of some new policies and programs and the elimination of some old ones if agriculture is to advance to its full potential.

Conclusions

A substantial potential for profitable farming exists in the three Maritime provinces as well as a selective potential for expansion of particular enterprises. Yet progress in the development of agriculture is seriously handicapped by the lack of recognition and acceptance of the changes in the agricultural environment and of the new pattern of resources and conditions to which farming must be adapted if it is to be profitable.

This lack of recognition of these new considerations in agriculture can be attributed partly to traditional attitudes and inertia but mainly to the lack of the competent research necessary to provide full and accurate information.

If agriculture is to be developed profitably and the pitfalls of the past avoided, it is essential that development guidelines be provided by such research. A major objective of this study was to provide such basic guidelines and information. The main conclusions of this study, briefly summarized here, indicate the nature of these guidelines.

1. Many weaknesses of traditional agriculture in the Maritime provinces have been exposed by the advance of the new technological and market environment.

2. In this new technological environment, the Maritime provinces are less adequately served with agricultural resources than was assumed under earlier circumstances.

3. Because of topography, soil, climate, drainage and other characteristics, the land available for agriculture in the Maritime provinces is less extensive and less productive than has generally been recognized. Special studies will be required to identify and delineate the quality and quantity of lands available and suitable for continuing agriculture.

4. Several climatic characteristics tend to mislead the unwary regarding the potential productivity of the land in the region. The long frost-free period gives a poor indication of the period of growth; the greenness of the sward is an inaccurate measure of the abundance of growth; and the spring and fall temperatures may be inadequate measures of the wind-chill that inhibits the profitable grazing of livestock.

5. The pattern of natural vegetation and land resources would indicate that more of the land now in agriculture should be in forest uses. Consideration should be given to the potential for forest farming enterprises.

6. The shortage of high-quality land suitable for some types of land-based farming should not be a handicap to the competitive production of food products today because the Maritime region is able to compete effectively not only in some land-based enterprises but in many enterprises that require little land.

7. Traditional attitudes, institutions and policies will handicap the development of the full potential of agriculture until they can be adequately adapted.

8. The technological environment for agriculture in Canada has changed remarkably since the war of 1939-1945. Traditional small-scale farming in the Maritimes is not in harmony with the new technological environment.

9. The numerous small-scale farm enterprises in the Maritimes are ordinarily unprofitable and their prospects are not favourable. It is probable that very few of these small enterprises will be adapted to the new larger-scale technology.

Almost all of them may be expected to revert mainly to rural residential uses or to be abandoned within the next decade or two.

10. Agriculture will play a much smaller role in the Maritimes in the future, in terms of numbers of farms and farmers, than it has in the past, but - in terms of total output and profitability - agriculture should play a much more prominent role.

11. There is currently much waste in the use of land in the Maritime provinces, partly because the qualities of the land have not been identified sufficiently to permit it to be directed into its most productive uses and partly because so much good ex-farm land is being abandoned to grow up in brush, weed trees and trash rather than being planted beforehand with commercial forest seedlings.

12. New approaches to land development are urgently needed if the losses from such misuse are to be prevented. Primary steps in such new approaches would be a comprehensive appraisal and identification of the land resources in each province and a comparative analysis of the potential of forest farming versus agriculture in the areas where farm land abandonment is now evident and prevalent.

13. Farming improvements will provide only part of the remedy for low incomes in rural areas; most of the remedy lies in providing attractive alternative employment elsewhere.

14. Until underemployment and low incomes in rural areas are remedied, the population and the potential market for farm products will not expand very rapidly in the Maritimes.

15. Agriculture in the Maritime provinces will continue to decline and adjust until it is more in harmony with the new technological and market environment.

16. The pattern of agricultural production in the future will differ markedly from traditional farming. Farm policies will need to be adapted to the emerging pattern; that is more in keeping with the needs of the larger-scale enterprises. Such adaptation should be based on appropriate research.

17. The two major weaknesses in farm financing are in the limited availability of operating capital and of mortage loans large enough to permit expansion of farms to economic size.

18. A great deal of research in markets and marketing should be carried out initially to guide the expansion of agriculture and to assist in the development of more suitable marketing facilities and services.

19. The great lesson to be learned from all this is that agricultural development in the Maritime provinces can no longer

be the rough-and-ready operation it has so often been in the past but must be based on research and sound data if it is to be profitably competitive.

20. There is a substantial potential for the expansion of profitable agriculture in the Maritime provinces in particular enterprises. The measure of success achieved in such expansion will depend greatly upon the effectiveness of the policies for development.

3. SUPPLY OF LAND FOR MARITIME AGRICULTURE

The supply of land for agriculture is usually limited to those areas which are most profitable in agricultural uses. For the use of land, agriculture must compete with forestry, recreation, wildlife, and other uses. In this competition for the use of land, agriculture is frequently placed at a disadvantage relative to these other uses because it demands special physical attributes in the land. Thus such features as soil, topography, climate, location, etc., usually limit agricultural uses of land more than other uses.

These land uses that compete with agriculture range from the high-valued urban uses, such as residential and manufacturing sites, to the low-valued extensive uses such as barrens and wastelands used for game and fur. Most of our farm land falls about midway in this overall range of land uses. Intensive agriculture, such as market gardening, competes strongly with urban uses, while extensive agriculture, such as cattle grazing, competes strongly with forestry uses.

Thus, for land to be considered potential agricultural land, the net benefits per operator obtainable from the land's use in agriculture must be as great as or greater than the returns obtainable by way of the other uses that compete with agriculture. This means that the amount of land available for agriculture in New Brunswick, Nova Scotia and Prince Edward Island depends upon the net returns from land put into particular agricultural uses relative to its net returns in other uses. Crops compete with one another; they also compete with pasture and forests. These net returns in agriculture depend in large measure on the physical character of the land, and thus the supply of land for agriculture depends basically on these physical characteristics.

In general, the land's physical characteristics are more significant in using land for agriculture than for other uses. This is because agriculture does not thrive under as wide a range of physical conditions as other uses, like forestry and recreation, may. In addition, physical attributes, such as topography and stoniness, limit the use of land for crops more than they limit its use for pasture. Within the limits established by the physical characteristics of the land, human choices and decisions, influenced by economic and other social forces, determine the type and intensity of use.

These physical, economic and institutional influences have operated over nearly two centuries in New Brunswick, Nova Scotia and Prince Edward Island to establish a pattern of land use. The early historical experience is still quite evident in the pattern of many farming enterprises. It is also evident that physical obstacles (soil, topography, stoniness, drainage, etc.) have held back the adaptation of Maritime farming operations to the new postwar technology that has so greatly influ-

enced Canadian agriculture as a whole. The influence of these physical obstacles is significant. They have resulted in only a small proportion - less than 4 per cent - of the total land in Nova Scotia and New Brunswick being improved for use in farming. (See Table 3-1.) In Prince Edward Island over 40 per cent of the total land area is improved. Of the total land in farms in the three provinces in 1966, Nova Scotia had only 26.2 per cent improved, New Brunswick had 35.3 per cent improved but Prince Edward Island had 61.5 per cent improved. Only in Prince Edward Island is the proportion of improved farm land close to that for Canada as a whole.

The potential for agriculture in these three provinces rests in the first instance on the suitability for farming of the physical conditions, including geology, topography, soil and climate. These physical characteristics are examined first, then the economic and other social characteristics.

TABLE 3-1

Land Areas in the Maritime Provinces, 1966

	Unit	New Brunswick	Nova Scotia	Prince Edward Island
Total land area	000 acres	17,814	13,057	1,398
Total area of all farms	000 acres	1,812	1,852	927
Improved farm land	000 acres	639	486	570
Improved land as proportion of all land	%	3.6	3.7	40.8
Improved land as proportion of all farm land	%	35.3	26.2	61.5

Source: Census of Canada, 1966.

Geology

Nova Scotia, New Brunswick and Prince Edward Island form the northern end of the Appalachian mountain region. All these provinces have long and deeply indented coastlines. The geological history of the region provides a first indication of characteristics relative to agriculture. This Appalachian region reaches as far south as Arkansas in the United States. The Canadian Appalachia includes, in addition to the three Maritime provinces, the province of Newfoundland and the Gaspé area of Québec. It is a region of uplands and lowlands, the latter carved by glaciation out of the areas where softer rocks occurred.

The Appalachians in Canada are comprised of folded mountain ranges that tend to run parallel to the St. Lawrence River. These uplands are composed of igneous, metamorphic and sedimentary rocks of the Silurian, Devonian and Carboniferous periods. Prolonged erosion, glaciation and weathering have rounded and filled them to a degree, but the relief still remains generally severe relative to farming requirements.

The early Cenozoic period was a time of uplift and erosion and the lowlands in the central part of New Brunswick, and most of the northern part of Nova Scotia were created in that period. The youngest consolidated rocks of the region include red sandstone and shale as well as some volcanic rocks found on the shores of the Bay of Fundy.

Topography

Topography describes the physical features of an area, especially the configuration of the land surface, including its relief, the extent and location of lakes, streams and mountain ranges. Configuration of the land surface has always been important in the productivity of cropping enterprises, but with the recent developments in mechanical and other technology in agriculture, topography has become a much more significant factor in determining the profitability of land in farming uses. Today, successful agriculture requires land more level than that required under horse culture. Tractor power, mechanized tillage, the use of wide booms for spraying - all require a greater degree of surface levelness than was the case when farming was done with horse power. With horses it was usually satisfactory to use land with a fall of not over 15 feet in 100 for tilled crops. (See Baker, 1923: p. 17.) Today the slope must be much more moderate than this for most effective farming. Even for pasture land there is a limit to the steepness of slope that can effectively be improved for grazing livestock. Moreover, while the economic supply of land can sometimes be increased by levelling, such a mass movement of soil is likely to be a costly operation, profitable only for small areas where the land is highly valued for special uses.

Because of local topography, the new large-scale technology that has recently become available has had a more adverse impact on farming in the Maritimes than it has on areas of more favourable topography in Canada. This is because so much of the land formerly devoted to farming with horse power in these three provinces was close to the margin in unevenness of topography. Only by the use of horse-drawn machines for cultivation, was the topography perhaps tolerable. For large-scale tractor-power operations, the same topography became a severely limiting factor in competitive farming.

Although the land surface of the Maritime provinces is relatively uneven, the amplitude of relief is not great - the highest altitude is only 2,700 feet above sea level. These

provinces are part of the folded Appalachian mountain region which has undergone modification through faulting and folding during several mountain building epochs.1/ The upland areas in these provinces show evidence of being the remnants of old erosion surfaces preserved on the harder rocks. Later, in the Ice Age of the Pleistocene period, great ice sheets spread over the land and, when melted, left a great mixture of unconsolidated material unevenly spread over the bedrock.2/ As a result of this glaciation the earlier topography and relief have been transformed by changing almost completely the previously established drainage patterns and causing the country to be dotted with swamps and lakes. These changes in turn led to an extensive new network of rivers and their tributaries which cut the terrain into numerous small areas. The result was that few large areas of level land with good soil and drainage remained. Most of these are found in Prince Edward Island. Drainage is frequently poor in the lowland areas of Nova Scotia and New Brunswick. Much of the land suitable for cropland is broken by ridges, valleys, hills and bouldery knobs that reduce the area of fields that might be available for large-scale machine operations. (See Frontispiece.)

In Nova Scotia, with an area of 21,068 square miles, the land is mostly of low relief. Yet ridges of up to 1,000 feet in altitude run lengthwise through the centre of the province, and the Cobequid Mountains run east and west along the northern part of the mainland. Cape Breton Island is almost bisected southwesterly by the Bras d'Or Lakes and consists mainly of a wooded upland rising in the north to a height of 1,747 feet, the highest point in the province. The Atlantic side of the province is generally rocky and deeply indented with bays and inlets.

The main agricultural areas of the province are the slopes of the Bay of Fundy and the Northumberland Strait. The Annapolis Valley, along the coast of the Bay of Fundy is the major agricultural area. Dyking to prevent saltwater flooding has added a considerable acreage in this area and in the vicinity of Amherst. Aside from these marshlands, which are costly to maintain and limited in range of production, most of the farming areas are steeply rolling, patchy and uneven.

1/ See Putnam (1961), p. 76; Camu, Weeks and Sametz (1964), ch. 1; and Canada Year Book (1960, 1963-64).

2/ Glacial features include moraines, drumlins, kames and eskers.

New Brunswick, nearly rectangular in shape, has an area of 28,354 square miles. The surface of New Brunswick is mostly undulating. The great Northwestern Plateau, 1,000 to 1,500 feet above sea level, is deeply dissected by valleys tributary to the St. John River and by the Restigouche River. The St. John River, with its numerous tributaries, winds generally southward across much of the province to the Bay of Fundy, while the Restigouche, bisecting the Plateau, carries the water from its tributary valleys generally northward into the Bay of Chaleur. In central New Brunswick are the Central Highlands consisting of a dissected plateau about 2,000 feet above sea level, surmounted by numerous hills of resistant rock. Numerous valleys, including the many branches of the Miramichi River, have trenched this central area into deep channels 1,000 feet or more below the summit level of the plateau. In the south of the province an upland area of widely separated folded ridges provides a more moderate relief. In the main, the topography of New Brunswick is generally uneven and steep. The valley of the St. John River is the major lowland area. But even in these areas most suited for agriculture, the land for the most part is strongly undulating and frequently broken by gullies, ridges and hills.

Prince Edward Island is the smallest province in Canada, 2,184 square miles in area. Although glaciation smoothed the Island's surface and disrupted previous drainage patterns, the major topographic and hydrographic features were well established before glaciation. Most of the surface undulates gently at elevations of less than 200 feet above sea level. There are no pronounced uplands, but there are two hilly districts where altitudes rise as high as 450 feet. One of these extends across the Island in western Queen's county from New London Bay on the north shore to the south shore eastward from Victoria; the other lies across the border between Queen's and King's counties in the Culloden-Caledonia area in the southeast of the province. From Summerside westward the surface tends to be flat and low with much low swampy land northeastward from Egmont Bay. The eastern half of the Island is more rolling and somewhat higher than the western half. Local relief influences the Island's land use, with the flatter areas frequently being poorly drained and the steeper slopes often being excessively drained and eroded. Since most of the soils are relatively sandy, even a moderate slope results in substantial erosion. Most of the farm land is associated with slopes of 2 to 4 per cent or less in the gently undulating areas.

Soil

In general, the soil characteristics of the land as they apply to agriculture can be considered as determined mainly by nature. Although the physical structure and composition of the soil can be changed by man's utilization practices, including tillage, drainage, fertilizer and other techniques, the basic productivity of the soil rests mainly on its natural properties. Thus, draining land or adding lime or artificial fertilizers may improve the soil and lead to higher yields, but generally, if agriculture is to compete with other land uses it must have a soil containing a substantial amount of natural fertility. In short, the physical, chemical and biological nature of the soil must be closely suited to agricultural uses. Soils, to produce abundantly, must contain adequate amounts of the nutrients essential for plant life, particularly nitrogen, phosphorus and potassium, and have desirable texture, structure and chemical reaction (acidity). In general, also, those soils containing more finely divided particles and a large amount of organic matter can furnish the most plant food and thus sustain more plant life and be more suitable for agriculture.

Yet, while a suitably fertile soil is an essential for agriculture, soil alone is not enough. Soil must be adequately supported by the other land characteristics (topography, climate, drainage, freedom from stones, location) if it is to be the basis for effective farming. This dependence of agriculture on soil and numerous other factors has not always been recognized in the settlement of land for farming in the Maritime provinces.

It is common to find that adequate studies of soils and their mapping are not carried out until the agricultural industry encounters adverse conditions. Thus, soil survey work was started in Ontario in 1914 in a small way but was extended from 1924 on, instigated by the tobacco-growing potential of Norfold county. Soil surveys in Alberta and Saskatchewan were started by the agricultural colleges in 1921 after a period of widespread crop failure. In the Prairies the soil surveys were aimed at preventing further settlement and cultivation of low-quality lands. In the other provinces, soil surveys followed in later years - in Manitoba in 1927, in Québec in 1927, in British Columbia in 1931, in Nova Scotia in 1934, in New Brunswick in 1938 and in Prince Edward Island in 1943. In Newfoundland they had begun before union with Canada.

With this attention to the quality of the soil coming, in most provinces, long after most of the land had been settled, it is not surprising that much of the settled land was not particularly suitable for farming. Yet even after much of the land was settled there was a continuing tendency to overesti-

mate the quality of the land and the area of suitable land still available for farm settlement.1/

The chief reason for this kind of miscalculation of land suitability was that while there are many small and some large areas of soil reasonably suitable for farming, a major part of these are unsuitable because of their adverse topography, drainage, stoniness, isolation, climate or other unfavourable physical characteristics. More effective studies of the soils of the Maritimes would have brought to light many of these adverse features. But it was only after most of the land was settled that soil surveys began. The disadvantages of this for agriculture were very great. Putnam (1951) has noted this backwardness in soil survey work:

> "Canada has not been lacking in the introduction of new crop varieties and in the investigation of agronomic techniques, but the natural advantage of the country for an early development of soil science was neither utilized nor appreciated."

1/ For example, the Topographical Survey, Department of the Interior, in 1931 (see Canada Year Book 1934-35, p. 1,108) estimated the total agricultural land of Nova Scotia as 8.1 million acres, or 61 per cent of the total land area of the province, with 4.3 million acres (based on the 1931 Census) in occupied farms. Similarly New Brunswick was reported to have 10.7 million acres of agricultural land, or 60 per cent of the province's area, with only 4.2 million acres in occupied farms. Prince Edward Island was reported to have 1.3 million acres of agricultural land or 90 per cent of that province's total area, with 1.2 million acres in occupied farms. Although farm settlement continued for some years the land occupied as farms has declined substantially in the last three decades in both Nova Scotia and New Brunswick - from 4.3 million to 2.2 million acres in the former province and from 4.2 million to 2.2 million in the latter. Between 1961 and 1966, occupied farm land fell by 17 per cent in each province. In Prince Edward Island occupied farm land fell only from 1,191 thousand acres in 1931 to 960 thousand in 1961 and to 926 thousand in 1966 a drop of 3.5 per cent in the latter five years.

Almost all mature soils in the Maritimes are of the Podzol group, similar to those in the northern parts of Ontario and Québec and in Scandinavia. This Podzol group comprises the largest soil zone in Canada. Several environmental factors are involved in the formation of these podzolic soils: abundant precipitation; long, cold winters; short, cool summers; and a natural forest vegetation comprised largely of coniferous trees, like pine, spruce and balsam fir. Podzolic soils consist of a surface layer of organic debris from forest vegetation, underlain in succession by a grey leached layer, a yellowish-brown layer and a reddish-brown layer of accumulation. Many of the minerals (calcium, magnesium and potassium) have been leached out of the surface layers of soil (for effective crop growth the supply of nutrients must be located in the top several inches) by the action of acids released from decomposing forest litter. Other minerals, like the oxides of iron and aluminum, are also carried downward and redeposited in the subsoil. In general, these podzolic soils tend to be acid, leached and infertile. To make them fertile usually requires substantial investments in lime, fertilizers and humus.

The eastern Podzols of the Maritimes and southern Québec may be differentiated from those of the Canadian Shield (northern Ontario and Québec) because the eastern region receives more rainfall and its soils are weathered more deeply and more completely than those of the northern region (Leahey, 1946).

In New Brunswick the eastern Podzols may be illustrated by the soils in the upper Woodstock area. In this area the soils tend to be leached and acid. The top few inches of the soil profile (A horizon) consist of dark brown, or black, partly decomposed organic matter. Below this is a whitish-grey, ash-like leached layer (A_2 horizon) up to six inches in thickness. This is followed by a reddish or rusty-brown layer (B horizon), coloured by the leached iron and alumina deposits, which may run from 6 to 24 inches or more in thickness. The next layer (C horizon) comprises the parent material of the soil which in the Woodstock area is mostly glacial till and varies from grey to reddish-brown and red, depending on the extent of the leaching and the original composition of the till. (Stobbe and Aalund, 1944: 21-22.)

A similar Podzol pattern is found in Nova Scotia. The Woodville sandy loam of the Annapolis Valley illustrates this. A similarly acid and leached soil, it is more extremely podzolized than the Woodstock soils in New Brunswick.

The basic problem with these leached acid soils is one of building up and maintaining the soil fertility because the virgin soil is frequently too poor to grow crops.[1/] By care-

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1/ Compare Mackay and Munro (1964), p. 16-19; and Putnam (1951), p. 77-8.

ful improvement, satisfactory yields of many crops can be obtained at a cost. The Woodville sandy loam of the Annapolis Valley, for example, is one of the most desirable soils in this fruit growing region.

The soils of Prince Edward Island,except in areas of peat, muck and sand deposits, are virtually all Podzols. Under the influence of the cool moist climate and the original forest vegetation, podzolization generally resulted in a soil profile about two-and-a-half feet deep with a well defined ash-grey leached horizon just below the surface. The parent materials are mainly glacial drift, lying in a thick layer on the surface. These glacial deposits are derived mainly from soft, red sandstone bedrock, and the soils developed from them are ordinarily sandy, fairly free of stones and brown-red in colour. These soils are usually quite permeable, acidic and low in plant nutrients. Even the best of them require careful management to build up and maintain satisfactory soil fertility and structure.

Thus the soil pattern in Prince Edward Island is generally much more favourable than in the other two Maritime provinces. A survey by G.B. Whiteside in 1950 classified the soils of the Island into five categories ranging from "best agricultural land" to "non-agricultural land". Almost 57 per cent of the Island's area was included in his "best agricultural land" category, a classification that would be about equivalent to Capability Class 2 in the Canada Land Inventory. This "best" land distribution largely reflected the pattern of cleared land. It comprised all of eastern Prince and central Queen's counties, most of the area in western Prince between O'Leary and Tignish and scattered patches through King's county. There better lands are usually smooth to undulating, and well drained. Fine sandy loams are typical of this category except in western Prince where clay loams comprise a major part in the O'Leary district.

The remaining soil categories suitable for agriculture, about 15 per cent of the Island's area, are typically disadvantaged either by poor drainage (low-lying or high-clay-content lands) or low moisture-holding capacity (porous sandy and gravel surface materials frequently associated with steep topography and erosion problems).

About 25 per cent of the Island was classed as marginal to submarginal for agriculture by Whiteside. This class included lands with unfavourable topography as well as drainage, erosion and moisture-holding problems. A very small area of the Island was classed as unsuitable for farming (extreme topography, bogs, sand dunes, etc.) perhaps no more than 3 or 4 per cent in total. It would seem likely that, with the advent of new technology that has occurred since the Whiteside study was made in 1950, a considerably larger proportion than this would be classed as land submarginal or unsuitable for agriculture in the Island.

In general, the soils of the Maritime provinces are one of the most critical elements determining the comparative advantage of these provinces relative to other major farming regions. Thus, in the first place it is in the land areas of the Maritimes that are not excluded from agriculture by topography, poor drainage, stoniness, bedrock or other physical handicaps, especially in Nova Scotia and New Brunswick, that we must seek the agricultural soil potential. But even where these other conditions are generally suitable, the soils are not naturally productive in terms of availability of plant nutrients. The fertility of the soil must usually be built up, and this is a costly operation.

A further characteristic of soil in terms of its suitability for farming is its economic area. A great many farms in the Maritimes, especially in Nova Scotia and New Brunswick, are small because there is only a small area of land with soil suitable for farming or because the soil area is cut into undesirably small fields by topography, poor drainage, roads or stone fences. Such lands may be uneconomic for farming, even though the soil is suitable, because the fields are so small or misshapen that the advantages of large-scale mechanized equipment cannot be enjoyed. It is essential for the future progress of Maritime farming that this aspect, the economic cost of the adverse size, shape and location of suitable soil areas, be adequately appraised.

It was considered possible that the information for such an appraisal might be obtained from the detailed source data used in the Canada Land Inventory. A special study of these data was undertaken for the Atlantic Development Board in conjunction with this study and they were found to be generalized and averaged too much to be adequate for identifying the precise location and area of tracts of land that were economically suitable in this respect for profitable farming in the future. If agricultural development is to follow a successful path in the Maritimes, a special study of those areas with the greatest potential must be carried out.

Drainage

In its natural form, drainage is concerned with the effective run-off of surface water as well as with the freedom for percolation of the water through the soil. Thus, the drainage of agricultural land is usually related to its topography or to its internal composition, or to both. Poor drainage usually follows low areas. Frequently, where surface drainageways have not developed well, the runoff drains into a series of stagnant ponds, bogs or muck-filled depressions. In addition, where bedrock is near the ground surface the internal drainage is frequently impeded, and wetlands result if the area is low-lying. A similar situation arises with soils in which an impervious lower layer has formed, and poorly-drained (gleisolic) soils develop.

In all three Maritime provinces the undulating topography generally provides ample slope for surface-water runoff so that at least the upper slopes of the land are ordinarily well drained. Yet in Nova Scotia and New Brunswick the lower levels are frequently poorly drained because of bedrock lying close to the surface or because impervious formations occur in the lower layers of the soil profile. Thus, although both provinces have unusually close networks of rivers and river tributaries, the many low-lying areas with blocked drainage-ways result in numerous small lakes, ponds and bogs. These, together with bedrock outcroppings, are a particular handicap on agricultural land because they obstruct large-scale tillage and frequently make it necessary to cultivate only on a small-field basis.

In Prince Edward Island, however, with its thick mantle of glacial drift covering most of the Island and with very little bedrock near the surface, the problems of drainage are much less severe than in the other two Maritime provinces. Only in the very low-lying or depressional areas, as in central and western Prince county and throughout Kings county, is the land poorly drained. These poorly-drained soil phases comprise probably 20 per cent of the total land area of the Island.

A major part of Nova Scotia is poorly drained, mainly because of underlying bedrock which prevents adequate percolation and runoff. Most of Nova Scotia remains in forest cover because of this. In the north-central area of New Brunswick this surface bedrock similarly supports forest rather than agricultural vegetation. In addition, east-central New Brunswick comprises an extensive network of rivers (Miramichi, Salmon, Richbucto, Buctouche, and others) with much of the area flat, relatively low-lying (500 feet or less above sea level) and poorly drained. This too is an area likely to remain in forest. Probably two-thirds or more of New Brunswick's land area would be excluded from agriculture uses by surface bedrock and low-lying, poorly-drained lands. In Nova Scotia the proportion would be larger.

The costs of improved or artificial drainage are usually relatively high in comparison with the net productive value of the drainage improvement. For this reason, much land that could be brought into farming use by improved drainage remains in other uses. In general, the investment in drainage (including both capital and maintenance costs) would be likely to yield higher returns elsewhere if invested in inputs of fertilizer or other improvements on higher-quality soil in well-drained areas.

Stoniness

Land to be used for cultivated crops or for hay must be relatively free of stones.1/ This freedom from stones has become more significant in recent years in determining the suitability of land for farming because of new farming technology and the advent of large-scale machine tillage. Even on hay land, stones have become a serious hazard to the use of high-valued hay-harvesting equipment. For grazing land, scattered stones may not be a major problem except that they inhibit its improvement by cultivation and fertilization, and also provide a nucleus for the growth and spread of brush and small trees. In the potato-growing areas of New Brunswick, small stones the size of hens' eggs present no problems for the machines used. It is the larger stones that are troublesome.

There has been some mechanization of stone removal but its cost is still quite high. Thus, today the cost of removing stones and forest growth is frequently excessive in relation to the resultant increase in the productive value of the land. For this reason, the clearing of stones and forest growth from virgin land for tillage crops has diminished in recent years.

A substantial part of the land in farms that has been improved in the past for crop or hay production in New Brunswick and Nova Scotia has been too rough and stony for modern machine tillage and accordingly much of it has already reverted to forest uses. Much farm land still remains in "permanent" pasture, because of stones and rough topography. Such land also will continue to revert to brush and small trees.

In the soil mapping of the Woodstock area, one of the most productive agricultural areas in New Brunswick, almost 9 per cent of the land was classified as rough and stony in 1939 (Stobbe and Aalund, 1944: p. 55). The area of this stony phase would probably be greatly extended by 1967 in view of the new limitations imposed on stoniness by large-scale machine tillage. In the Annapolis Valley, a similarly superior farming area in Nova Scotia, the stony phase comprises a large proportion of the land area. Throughout most of the other farming areas in these two provinces much of the land is bedrock-controlled or too stony for effective tillage. It may be expected that this stony land will continue to revert to forest and to be abandoned for farming uses in the future.

1/ It must also be relatively free of forest growth, which presents obstacles to cultivation similar to those presented by stones.

In Prince Edward Island, however, the land is relatively free of stones. The soil parent materials were originally soft red sandstone weathered to form a generally sandy and stone-free soil. Even where stones remain they tend to be relatively soft. This freedom from stones, along with less extreme topography, gives Prince Edward Island a significant potential advantage in crop production over the other two provinces.

Vegetation

The natural vegetative cover provides a first approximation to the productive potential of the land. The nature of the original vegetative cover usually indicates the historical character of the environment in terms of climate, soil and other physical factors. In the case of natural grasslands, the vegetation itself may significantly modify these conditions. Similarly, when the tree cover is removed the micro-environment changes materially, in the direction of more light, more variable temperatures, more variable moisture and much greater transpirational stress. This new environment tends to be hotter and drier and, should such land be allowed to return to forest cover, it may frequently produce only valueless species or even become barren for a time.

The vegetative cover can be interpreted as a representation of the whole ecological environment - climate, soil, drainage, etc. With this interpretation, the vegetative cover can be a most useful indication of how the physical environment will affect agricultural production. In short, the natural vegetation indicates the kinds of field and forage crops that are likely to be most suited and productive in that particular environment. Broadly, grasslands usually indicate a potential for crops requiring only moderate rainfall - crops such as hard wheat and drouth-resistant grasses. Forest lands, on the other hand, are usually more suited to pasture, hay or feed grain crops but, because forest lands are commonly podzolized, they frequently have lower productive capacity than natural grasslands. This tends to be the case in the Maritimes where most of the land in agricultural use was originally forest land and is podzolized. This together with other adverse characteristics puts the best land into second- or third-class categories in terms of its productivity relative to other major farming regions.

The forests in the Maritimes were a mixture of softwoods and hardwoods and were both coniferous and deciduous. In Prince Edward Island most of the land has been cleared and occupied by farms, with no extensive tracts of forests but much land in farm woodlots. The other two provinces have large forested areas, many of which have been cut over and now require extensive culling or suitable seeding and replanting. In 1967, in both Nova Scotia and New Brunswick, a considerable part of the land formerly in farms was in process of reverting to forest cover.

The nature and distribution of the forest cover is related to the physical environment. The suitability of forest land for agricultural uses can usually be measured by these same physical characteristics. For example, the natural forest cover in the Maritimes demonstrates that the climate is reasonably moist and temperate and that the soils will tend to be podzolized. The frequency of black spruce, cedar and tamarack demonstrates that poorly drained areas are extensive in both New Brunswick and Nova Scotia.

In the early years of development in the Maritime provinces, the forest was viewed chiefly as a major reservoir of potential farm land. Public policies were focused on settling farmers on the land as soon as it was cleared, with too little attention to its quality. The technique used for settlement, it has been suggested, was to slice the forest into 100-acre lots, regardless of the quality of the soil. (Putnam, 1961: p. 57.) This technique of settlement was continued, with modifications, well into the 20th century. The unsuitability of much of this forest land for productive farming has undoubtedly been a major consideration in current low productivity and low incomes in Maritimes farming and in the recent reversion of much cleared farm land to forest, both in Nova Scotia and New Brunswick. It suggests that much of such land would be more profitable in forest farming than in the production of tilled crops.

Climate

Climate is a significant determinant of the potential for agriculture in any region. In the Maritime provinces, climate is particularly significant because some features of it tend to provide misleading evidence of the productivity of the land. Aside from this, climate is important because much farming is based on plant growth and the climatic environment determines in large part the degree to which any plant will grow or thrive, given suitable soil.1/ In other words, the extent to which a particular plant may flourish depends upon the temperature of soil and air, the moisture available in soil and air, the amount of sunshine, the exposure to wind and other climatic factors. Moreover, climate shows up in nature's cycle of plant and animal production, in which plants, built up by photosynthesis and other processes from nutrients supplied by soil, air and water, provide food for man and feed for livestock.

1/ Climate may also affect the degree to which farm animals will grow and thrive outdoors, as well as the nature and cost of the shelter required for them.

The suitability of the climate of the Maritimes for agriculture is conditioned by their latitude, altitude and position relative to nearby bodies of land and water that serve as source regions for the air masses that, in moving over them, influence their climate. These two factors of location and height above sea level provide a first approximation to a region's climatic environment. This environment can then be measured further in terms of its agricultural potential by temperatures, precipitation, humidity, sunshine and wind.

In latitude, the Maritimes lie between 43° and 48° north latitude. In relation to its position in the vegetation region of Canada that lies east of Lake Superior, this would indicate that Maritimes agriculture might tend to be marginal. Ontario's best farming area in southwestern Ontario including the Niagara Peninsula, lies south of this. Only the St. Lawrence lowlands are as far north.

Altitude, for the most part, is not a restriction to Maritimes agriculture. Most of the area is less than 500 feet above sea level, much like the St. Lawrence lowlands. In short, altitude itself does not cause temperatures to fall too low for agriculture.

The source regions for the Maritimes climate are mainly continental Canada and the Atlantic Ocean. In North America, air masses affecting climate usually tend to move from northwest to southeast and this makes northern Ontario and Québec the major source regions. At the same time, the Maritimes stand out into the Atlantic and are extensively exposed to the western environment of that ocean. They lie too far west to be exposed to the warm Gulf Stream moving north, but lie directly in the path of the cold Labrador Current that flows south through the Strait of Belle Isle. This cold Current ordinarily delays the start of the growing period in the spring. The marine air of the Atlantic is also responsible for a high relative humidity.

Investigations show that climate in Maritimes agriculture is particularly significant for three reasons. One reason is that the climate of the Maritimes is somewhat less advantageous for farming than it is in the most productive regions in Canada. A second is that several climatic evidences may be misleading. A third is that although the climatic disadvantages of the Maritime provinces may seem moderate individually, together they are sufficient to contribute substantially to making many types of agricultural enterprises in the Maritimes relatively marginal in comparison with those of more suitable regions.1/

1/ The term "marginal" is used here in a relative sense. Most of the farming in the Maritimes could compete (i.e., was probably within the profitable competitive margin) with other regions before the recent technological revolution in agriculture. If demand for farm products should rise enough to increase prices substantially, much more of this agriculture might thereby rise above the profitable margin.

This appraisal compares certain measures of the climatic suitability of the Maritimes for agricultural production.

Temperature influences the rate and variety of plant growth in any region. Farm crops require certain external temperatures of soil and air to carry on their life processes. Plants require certain minimum temperatures for growth. Ordinarily the closer the temperature remains to this minimum, the slower the plant's growth and, conversely, the higher the temperature, within limits, the faster the growth, given satisfactory moisture and related conditions. In addition, for various plants to mature and ripen, satisfactory temperatures of soil and air must be maintained over an appropriate period. On the other hand, extremes of cold tend to damage crops and reduce the rate of gain of meat animals or the output of milk or eggs from a given amount of nutrients. This coldness may be related partly to temperature and partly to wind and humidity.

In precipitation the Maritimes usually have an adequate supply to meet agricultural requirements. Mean annual precipitation ranges from an average of 55 inches along the southeastern coast of Nova Scotia to less than 40 inches in northwestern New Brunswick. In Prince Edward Island precipitation averages just over 40 inches (Canada Year Book, 1959, 1960). This fall of precipitation is heaviest during the winter months. For example, during the nine months September to May inclusive, the precipitation in Charlottetown and Moncton was 33.8 and 31.2 inches (of water) respectively, but in London, Ontario, it was only 28.3 inches. In the crop growing months of June, July and August, however, Charlottetown and Moncton averaged 9.3 and 9.8 inches of rainfall respectively while London averaged 9.9 inches. This overall volume of precipitation together with the high relative humidity (Table 3-2) due to inflows of Atlantic air, tends often to provide more than enough moisture for farm crops, usually with some excess evident during the haying season. Precipitation is generally reliable but it varies in amount fairly frequently. In Prince Edward Island a study shows that at least one summer month with less than an inch of rainfall may be expected every six or seven years. Yet surplus moisture conditions during the growing season are also common in Prince Edward Island (Raymond, McLellan and Rayburn, 1963: p. 15).

The high relative humidity in the Maritimes (Table 3-2) is undoubtedly a significant handicap in livestock operations. The high moisture content in the air appears to add considerably to the chill factor in spring, fall and winter (Thomas and Boyd, 1957: p. 29) requiring more feed consumption by farm animals to maintain their body temperature, more indoor feeding, and more costly shelters to protect them. In short, high humidity in the colder weather may reduce the rate of gain of beef feeders or the output of meat, milk or eggs per unit of nutrients fed. It can also shorten the grazing season and increase the cost of shelter for animals and poultry.

TABLE 3-2

Long-Term Climatic Data, Selected Stations

Station	Height Above Mean Sea Level	Average Annual Precip-itation	Average Frost-Free Period	Average July Temper-ature	June-August Heating Factor Below 65^{o}F	Average Date of Last Spring Frost	Average Bright Sun-shine June-August	Average Relative Humidity June-August	Average Yearly Days of Rain (June-August in brackets)	Windchill January
	ft.	in.	days	^{o}F.	day-degree	date	hours	%	days	^{o}F.
Charlottetown	74	43.13	150	66.6	380	May 16	701	69*	115 (34)	2
Halifax	83	54.26	151	65.0	339	May 13	670	64*	126 (35)	11
Fredericton	164	41.90	126	66.6	302	May 20	657	52*	114 (37)	2
St. John	119	47.39	164	61.8	470	May 4	623	70*	137 (41)	3
Moncton	248	40.97	104	65.8	330	June 1	652	56*	109 (33)	-4
London, Ont.	912	38.24	137	69.6	150	May 16	773	59‡	112 (30)	9
Winnipeg, Man.	786	19.72	110	68.4	259	May 27	807	56#	66 (32)	-20
Saskatoon, Sask.	1,690	14.40	111	66.4	350	May 24	911	43**	57 (31)	-18
Calgary, Alta.	3,540	17.47	91	62.4	550	June 3	819	48**	56 (32)	4
Grand Prairie, Alta.	2,190	16.80	103	60.7	420	May 23	817	47**	68 (35)	-3

* As recorded daily at 1400 hours A.S.T.

‡ As recorded daily at 1300 hours E.S.T.

\# As recorded daily at 1200 hours C.S.T.

** As recorded daily at 1100 hours M.S.T.

Source: Canada Year Book 1959, 1960.

In temperature, the climate of the Maritimes has both advantages and disadvantages for agriculture. Lying close to the northern limit of agriculture in terms of latitude, the influence of the Atlantic Ocean tends to moderate the temperatures of the region. It is cooler in summer and less cold in winter as a result of the ocean environment. The cooler summer temperatures are a disadvantage for crop growth, especially those of the autumn months where warmer temperatures are required for maturing many crops. In this respect, the disadvantage of Charlottetown relative to London, Ontario, is illustrated by the lower monthly mean temperatures (Table 3-3). In May and June the temperature advantage of London averages over six degrees, but in every month London has some advantages.

TABLE 3-3

Mean Daily Air Temperature

	Charlottetown	London
	°F	°F
May	48.6	54.5
June	58.4	64.9
July	66.6	69.6
August	65.9	68.0
September	58.4	60.9
October	48.4	49.2

Source: Canada Year Book, 1960.

These temperatures during the growing season are important for agriculture. They require particular attention for Maritime agriculture. Frequently, the examination of temperatures for agricultural production ends with the determination of whether the frost-free period is of sufficient length for most crops. This measure is not adequate in this case because the frost-free period fails to take adequate account of the coolness of temperatures during the growing season. In short, the effect of the Atlantic Ocean is to moderate the low temperatures in the spring and fall and thus extend the frost-free period, on the one hand, but it also moderates the high temperature of summer and thus reduces the length and warmth of the growing season and the rate of growth, on the other hand.

This two-directional moderating effect of the Atlantic environment may be illustrated by various measures of temperature. Thus the average frost-free period in the Maritimes (Moncton excepted) is longer than in most crop-producing areas in Canada (Table 3-2). Yet the average temperature in July is lower there than in either London or Winnipeg. The influence

of the Atlantic Ocean in lowering the Maritimes temperature during the growing season may also be measured by the heating factor, that is, by the number of day-degrees that the temperature falls below 65°F in the growing period. In the regular growing months of June, July and August, the Maritime centres are significantly behind London or Winnipeg in warmth - Charlottetown falls short of 65°F by 380 day-degrees while London is only 150 day-degrees below. The higher temperatures in September in London (150 day-degrees below 65°F) as against the Maritimes (Charlottetown was 240 day-degrees below) was also marked. It can be concluded that because of these cooler summer temperatures the rate and abundance of crop growth in the Maritimes will ordinarily be reduced relative to that of southwestern Ontario and parts of the Prairies. Another way of showing this deficiency of warmth is to measure the average accumulation of day-degrees above the mean daily temperature required for minimum growth (42°F), during the growing season. A Canada Department of Agriculture study covering nine points in Canada indicates the disparity between Greenwood, Nova Scotia, and Windsor or Ottawa, Ontario, for example (Table 3-4). The deficiency in hours with temperatures 72°F or above is particularly significant in the case of Greenwood.

The temperature of the soil may also be used for this purpose of comparing the length of growing seasons and the probable rate of plant growth. Another Canada Department of Agriculture report shows the average monthly temperature as measured at a depth of 10 cm. at several experimental farms, including those at Harrow, Ontario, and Fredericton, New Brunswick (Table 3-5). Relative to Harrow, the soil on the farm at Fredericton has substantial and continuing disadvantage in the temperature for germination and growth of crops.

Coldness is another feature of temperature that should be noted. This is measured by the temperature and wind combined in winter, that is, the windchill factor. Thus, although the ocean environment moderates the cold temperatures during the winters, the average winter climate as measured in windchill is colder in the Maritimes (except Halifax) than in London or Calgary (Table 3-6).

In spite of this general coldness of the climate the influence of the marine environment moderates the extremes of cold to an extent that makes possible the production of a wide variety of fruits in a number of areas where soil and slope are suitable.

An additional indication of crop growth potential may be found in the hours of bright sunshine during the growing season. For plant production, light (as well as heat and other elements) is necessary. It is by utilizing the light and energy of solar radiation that plants are able to convert inorganic chemical substances into carbohydrates and other plant foods. The greater the amount of radiation from the sun's rays available for plant photosynthesis the greater the rate of plant

TABLE 3-4

Degree-Day Comparisons at Nine Stations in Canada, Average 1950-56

	Average Date on which Accumulation of Day-Degrees Above 42^{o}F Begins	Average Accumulation of Day-Degrees by End of Season (November)	Average no. Hours with Temperatures 72^{o}F or Above During the Growing Season
Medicine Hat, Alberta	March 26	3,140	769
Winnipeg, Manitoba	April 15	3,020	670
Windsor, Ontario	March 19	4,380	1,265
Ottawa, Ontario	April 8	3,440	780
Greenwood, Nova Scotia	March 22	3,100	480

Source: Canada Dept. of Agriculture. Heat units and crop growth. Pub. 1,042. Ottawa, 1959. Compare p. 26: "Undoubtedly one of the greatest contributions to be made by the heat unit or degree-day theory will be that of crop zonation."

TABLE 3-5

Soil Temperature, 1959*

	Harrow	Fredericton
	^{o}F	^{o}F
April	43.5	38.0
May	58.7	54.5
June	68.9	60.1
July	75.7	71.3
August	75.8	67.3
September	69.6	60.3
October	56.6	50.2

* Data for 1960 were also gathered but were available only from August to the year end for Harrow, Ontario. For the period August to October, 1960, the comparison was close to that of the above table.

Source: Soil temperature records at eight localities in Canada 1959-1960. Compiled by J.G. Potter. Meteorological Branch, Canada Dept. of Transport, March 1962, Ottawa.

TABLE 3-6

Windchill

	Average Temperature Coldest Month	Average Wind Speed Same Month	Windchill Factor
	°F	m.p.h.	°F
Charlottetown	17.6 (Feb.)	13.3	-1.0
Halifax	23.4 (Feb.)	12.5	8.5
Moncton	16.1 (Jan.)	14.6	-4.0
St. John	19.8 (Jan.)	13.5	3.0
London	22.2 (Feb.)	11.9	8.4
Winnipeg	0.6 (Jan.)	12.7	-20.0
Calgary	15.8 (Jan.)	10.0	3.6

Source: Data from Canada Year Book 1960; formulas for calculation of windchill from Meteorological Branch, Dept. of Transport, Ottawa.

growth, other things being adequate. Brightness of the sunshine and the length of the day during the growing season are the critical factors determining the amount of radiation available for photosynthesis. Generally, in the Maritime provinces, lack of light or sunshine, as well as low temperatures, is a significant limiting factor in crop production. The Maritimes tend to be less favoured with bright sunshine during the June-August growing period than more westerly provinces having as much as 10 to 20 more per cent less bright sunshine. (See Table 3-2.) This deficiency in bright sunshine, resulting in excessive coolness and moistness is also a frequent disadvantage in the curing and drying of hay in the Maritimes.

Overall, the effects of the Maritimes climate on farm crop production are substantial. The relatively short, cool growing season reduces the rate and abundance of growth and has a selective influence on crop production. It gives an advantage to root crops, leafy vegetables like cabbage, and hay, pasture and forage crops. These climatic characteristics do not ordinarily favour grain crops in the Maritimes compared with the climatic character of areas like southwestern Ontario and the Prairies. Grain production cannot readily be adapted to the cool summer growing season, high relative humidity, and the tendency for autumn to be too cool for final growth and full ripening of grain kernels. Early maturing varieties do not solve these deficiencies in climate, though they help some.

The disadvantages in curing hay and in maturing grain and other crops are substantial. They give advantage in cost and quality to silage over dry hay relative to other regions. The relatively cold autumn weather is a major disadvantage for grain crops such as wheat or corn. The grain crops with a

shorter growing season, like barley and oats, may mature in most years but their abundance of growth is reduced by the coolness of the growing season while difficulties of harvesting them are enhanced by the high relative humidity.

The comparative coolness of the spring and autumn seasons reduces the rate and abundance of pasture growth and in effect reduces substantially the length of the growing season relative to competing regions.

The relatively moderate winter temperatures resulting from marine influences make possible the production of a fairly wide variety of fruits when soil and slope are suitable.

Yet the relatively raw and windy climate in winter may be expected to reduce the rate of gain and increase the cost of maintaining livestock and poultry. With windchill fairly high in winter in the Maritimes relative to other livestock producing areas it may be expected that the rate of gain or the output (of meat, milk, eggs, etc.) per unit of feed nutrients consumed may also be somewhat less. This adds substantially to unit costs of production in the Maritimes. This extra windchill also adds to the costs of shelter required for livestock. Ordinarily, it is a serious handicap to the grazing of livestock, especially in the spring and fall.

Location

Agricultural products tend to be produced where they have the greatest comparative advantage. This comparative advantage for particular products may be related to the physical location of the area in terms of its proximity to markets and supply centres. In appraising the comparative advantage of farming it is important to recognize the significance of transportation costs in relation to differentials in production costs. Where there are no production cost differentials, the most profitable location for farming is at the point of minimum transportation costs, that is, closest to the market.

If the land area devoted to farming is very large and quite productive its location may be less significant than where the area is small and low in productivity. This is because the large and productive farming areas ordinarily command adequate marketing facilities (highways, railroads, buying and storage services) and well-developed facilities will usually be found there. But, where areas of farming are small or not very productive, the provision of marketing facilities and services tends to be costly and they are usually poorly developed and inadequate.

In the Maritime provinces, these locational disadvantages can be illustrated. Most of the farming areas are relatively small and frequently broken by rough topography and have only moderately productive podzolic soils. Moreover, the major Maritime farming areas tend to be some distance from the large

population centres or consumer markets, such as Montreal and Toronto. In consequence, the producers of farm products in the Maritimes tend to be faced with excessive distances to major markets, an unsatisfactory grid of local roads,1/ mainly low volume (and thus costly) market facilities, and frequent inadequacies of facilities and services in other respects. Unfortunately, in the main, the area and productivity of the land as now used in Maritime agriculture will not support more than this. If the scale of enterprises was larger, with the number of farms correspondingly fewer, they could undoubtedly be more adequately served, probably with fewer roads and less costly services because the volume per farm would be greater and more efficiently handled.

There is always an economic limit to the distance a farmer (or lumberman or miner) can transport his primary commodity and this limit depends upon the scale of productive operations, state of the roads, means of transport, cost of labour and market value of the product. In most major farming areas, railroad construction has been of major importance to farming development. But with most of the Maritimes farming areas relatively small, rail traffic volumes have also been relatively small and railways have made less contribution to Maritimes farming than to farming in other regions of Canada. Only with the advent of more efficient trucking services since about 1950 has more adequate transportation in the Maritimes become reasonably possible. At the same time, these new developments in highway transportation have been responsible for the decline of many small towns and villages in farming areas in Canada, a process that is now getting underway in the Maritimes.

Yet some of the new technology has improved the relative location of Maritimes farming. One of the most important developments in this respect is the quick-freeze processing of vegetables and other foods, which makes green vegetables, small fruits, etc., available to city consumers out of season. By this means of preservation the major city markets of Canada and the United States can be opened to Maritimes products, provided their cost can be kept low enough.

1/ Maps showing the utilization of land in the Maritimes illustrate this. In all three provinces the farming enterprises tend to cling to the roads, extending in the main along only a narrow strip of land on each side of the roadway. See, for example, Land utilization in Prince Edward Island, Memoir 9, Geographical Branch, Department of Mines and Technical Surveys, 1963, especially the enclosed map of land use in King's county. The pattern is frequently even more striking in the rural areas of New Brunswick and Nova Scotia.

As far as outside markets are concerned, Maritimes agriculture is in the main not conveniently located. From their position extending eastward into the Atlantic Ocean, they are an excessive distance from most major markets, considering the volume moved. Yet in certain other markets such as those in Newfoundland, the West Indies and some New England states (and comprehending products like eggs, potatoes, fruits, etc.) the Maritimes have some locational advantages. For most farm products exported from the Maritimes, however, the volume is ordinarily too small and the distance too great to warrant developing specialized transport facilities. In consequence farm products must fit in with the movements of non-farm commodities and this is seldom sufficiently economical or timely for profitable marketing.

Overall, the comparative advantage of agriculture in terms of location depends on both physical and economic conditions. The physical conditions include such things as the nature of the soil, climate and topography, and these, in many areas of the Maritimes are not particularly advantageous. The economic conditions comprise many factors beyond transportation and market services, including such other elements as the availability of labour, the supply of capital and the availability of technical knowledge. The smallness of farms and their dispersion into many small farming areas probably decreases the mobility, and thus improves the availability, of labour in Maritimes agriculture. Yet this dispersed location and distribution of Maritimes agriculture tends also to make the other economic conditions (supply of capital, technical knowledge, etc.) more difficult to provide than in other, larger farming regions. Because of this, remedying these disadvantages of location is more costly in the Maritimes than it is in some other major farming areas in Canada.

The Supply of Agricultural Land

In summary, then, the first step in appraising the agricultural potential of the Maritimes is to identify those areas which are likely to provide the most profitable enterprises for crop and fodder production. Second, it is necessary to appraise those farm enterprises which are not very dependent on land for their production in order to determine which of them are likely to be most profitable. Third, it is necessary to consider the other influences that may handicap Maritime farming in its adjustment toward more profitable farming enterprises.

For the first of these steps, a special effort has been made to appraise the land areas of the three provinces to identify those that appear likely to provide the greatest potential for profitable farming in the future. The data available for such an appraisal were inadequate and further work by way of air-photo analysis and additional soil surveys is needed to complete this requirement. Such projects should be given first priority in future research.

The second step, to appraise the profitability of particular enterprises that require little land for their productive operations, is carried out as a special part of this project, reported in detail in a separate volume, but summarized in Chapter 10 in this report.

The third step, consideration of the other influences that may prevent the adjustment of Maritime farming, is the subject of the next several chapters.

4. THE INFLUENCE OF THE SETTLEMENT PATTERN

The nature of the early settlement and development of a region affects the character of its traditions, institutions and general organization, which in turn facilitate or handicap the adaptation of agriculture to changes that occur in the economic environment. The nature of this early development influenced Maritime agriculture greatly.

In the early years, development of agriculture progressed very slowly in what is now the Maritime provinces. Although the first settlements were established by Monts and Champlain as early as 1604, there was very little expansion for the next 150 years. These first French settlers became the Acadians. They were the first farmers, settling first in the Annapolis Basin (Port Royal) and, with later immigrants, spreading out mostly to the grasslands - especially the salt marshes of the Fundy tidelands in the Chignecto area and in the Annapolis and Minas basin.

In the 150 years that followed this first settlement in 1604, the growth of population was not rapid. The number of Acadians grew slowly, increasing to about 400 (not including soldiers or officials) in 1671, to 2,100 in 1710 and to about 12,000 by 1750. By the latter year settlement and development in other parts of North America had progressed also and the potential of the continent was starting to be recognized. Both France and Britain viewed the Maritime provinces region as a potential outpost of colonial empire. France had built Fort Louisburg after 1713 and Britain established Halifax in 1749. Britain had determined to take over the region and initiated a plan to populate it with loyal settlers. The Acadians deported in 1755 (about 6,000) were replaced, mainly by New Englanders of British origin. A group of 2,500 settlers, including many German Protestants, had been sent out with Lord Cornwallis in 1749 to establish Halifax. In 1753 this German group settled in what is now the Lunenburg area.

During the next few years considerable numbers of other settlers arrived. About 4,500 New Englanders moved in between 1760 and 1763. About 500 settlers from the north of Ireland arrived about the same time. Between 1772 and 1774 close to 1,000 Yorkshiremen settled on the Chignecto Isthmus and in 1773 some 200 Scotsmen settled at Pictou. Although substantial, these immigrations were relatively modest compared with those that followed at the end of the American Revolution. When this conflict broke out in 1775 the population of the whole region of the present Maritimes was less than 20,000. But before turning to that, a word on the settlement of Prince Edward Island.

The settlement of Prince Edward Island began in 1719 with the establishment at Port La Joie of a small French colony. These first settlers suffered famine and disease in their several unsuccessful attempts to establish a permanent colony. In 1745

the colony was captured by the British but was returned to France by the Treaty of Aix-la-Chapelle in 1748.

In the next several years, a considerable number of Acadians in Nova Scotia were induced to move to Prince Edward Island (then Ile St. Jean) partly by the pressure in Nova Scotia to become British subjects, partly by the encouragement of the French at Louisburg. By 1752, about 2,000 Acadians had moved to Ile St. Jean with about 700 others moving at the same time to Cape Breton Island (Ile Royale).

In 1758 the British again captured the Ile St. Jean colony and Britain took two important steps soon after which were to have a significant influence on the future of the new island acquisition.

One of these steps was to grant to each of about 60 individuals, to whom the British Government was under obligations, an area of twenty thousand acres of land (MacNutt, 1955: p. 14). The objective was to create a planter or seigniorial system on the Island as a method of stimulating settlement. The absentee landlords were expected to develop and settle their holdings, but few actually did, and the economic progress of the Island was slow, with the "land question" a source of continuing dissatisfaction and bitterness to the settlers. This method of settlement actually retarded the development of the Island. Men were not prepared to labour as tenants when they could obtain free grants of land elsewhere (MacNutt, 1955). This "land question" was not settled in Prince Edward Island until after Confederation when the proprietors were bought out, but the small-farm tradition established in this earlier period has tended to remain in the Island's farming.

Britain's second important step was to constitute the Island a separate province in 1769 for the purpose of supporting this planter scheme of settlement. The population in that year was only 250 people so the burden of the elaborate structure of provincial government was heavy and difficult. It also gave rise to much political conflict.1/

Thus, by 1775, when the American Revolution broke out, agricultural settlement had made little progress in the Maritimes. Farming possibilities had been tested only on the land of the Acadians, which was mainly grassland. The rest of what is now the Maritime provinces was largely covered with forest, most of it rough and rocky in topography, and none of it effectively appraised for its farming potential. Aside from the remaining Acadians2/ the 20,000 people who had settled in the area were mainly newcomers (about half were New Englanders) who had arrived after 1760 and were quite inexperienced in farming under these primitive and disadvantaged conditions.

1/ In 1799, the name was changed to Prince Edward Island.

2/ See MacNutt (1955), p. 12 and Encyclopaedia Canadiana (1958) Vol. 7, p. 408.

It may be evident then that the great influx of Loyalists, soldiers and civilians, that came after the Revolution had little relation to the agricultural potential of the region. The settlement program that followed 1783 was concerned primarily with finding a home quickly for a great number of displaced people from the 13 colonies. Nova Scotia (then including what is now New Brunswick) was convenient; it had a relatively strong and stable administration and it had a great deal of unused and unexplored land presumed suitable for settlement. The fact that much of the land was unsuitable for farming apparently was not known and was of little concern to those responsible.

Both soldiers and civilians came to the Maritimes region as Loyalists after the Revolution. Some 35,000 in all settled there. Of these, about 12,000 settled in what is now New Brunswick, mainly in the St. John River valley. A few settled on St. John's Island, Cape Breton Island and along the rocky eastern coast of Nova Scotia. But the major Nova Scotia settlement was at Port Roseway on the south shore of the peninsula where some 10,000 Loyalists settled in 1783. There they established the town of Shelburne which they vowed would become a greater place than Halifax. They had come from a land of plenty and had encountered rock and forest. Shelburne was soon to become a forlorn monument to their disappointed expectations. Within a year or two after settlement it had become a fishing hamlet of a few hundred people (MacNutt, 1955: p. 17).

One immediate result of the Loyalist settlement was the setting up of New Brunswick and Cape Breton as separate provinces.1/

The Loyalist settlement was a major undertaking to the government authorities. It was carried out in haste, and was concerned with convenience perhaps more than with considerations of successful, permanent settlement. In the settlement program and in the policies to support agriculture which followed settlement there is evidence of a strong belief that virtually all parts of the Maritimes region had a great potential for farming. But it is also evident that this belief was poorly supported by either factual information or technical knowledge. This optimistic approach to agricultural settlement and development was to find favour for several generations in

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1/ The Loyalists who settled in New Brunswick had little love for the "old" inhabitants or the government of Nova Scotia whom they blamed for the mismanagement of settling them on the land. See MacNutt (1955): p. 18.

the Maritime region and its disadvantages are evident up to the present day. These current handicaps of the early settlement period have been succinctly summarized by Putnam (1951).1/

From the nature of the agricultural settlement pattern it must have been evident that many of the settlers could not avoid being handicapped in their farming operations and that they would remain so. Those responsible for administering the settlement program failed to have the quality of the lands appraised and much land that was quite unsuitable for agriculture was settled. Allotments of land were too small for either commercial farming or forest operations and were clearly suited only for providing part of a near-subsistence living. Because of the broken nature of the terrain and poor communications, the units of local government that were established tended to be relatively small, isolated from markets and from farming information and jealous of their local independence. This isolation tended to make local farmers and local governments impatient of outside control or guidance and subject to the handicaps inherent in the resultant narrow perspectives.

Perhaps the greatest handicap of early agricultural development was that the government administrators failed to recognize the deficiencies of much of the land they alienated for farming purposes. Yet these deficiencies should have been evident from the extensive subsidies for clearing land, for wheat production, oatmills, livestock production and other products, that were granted in these early years often at the behest of the mercantile, fisheries or carrying-trade interests. Early agricultural development has been said to have served primarily as an instrument of commercial and political empire.2/ In this early period, indeed, the belief seemed prevalent that any farm product that the government or merchants wished to have produced could be produced profitably. Nothing could have been farther from the facts. On most of the land that was settled, virtually no farm products could be produced with profits comparable to competing areas, and on the best of the lands the effort and costs tended to be excessively high. This failure to appraise effectively the physical capabilities and market possibilities for farm production was evident throughout the latter 18th century and much of the 19th. It became a tradition to promote farming

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1/ The small allotments, rough terrain, and arbitrary survey lines have resulted in many fields today being too narrow, too small, or too misshapen for modern large-scale farming machinery. This pattern of small irregular fields, separately owned, has been part of the difficulty encountered by farmers in organizing their suitable land into large enough fields for efficient machine operation. The other part of the difficulty is that areas of suitable land, regardless of ownership lines, tend to be too small for effective use of large-scale machines.

2/ See Fowke (1946) ch. III, and p. 65: "The defence problem was an important consideration in the extension of aid to Loyalist settlement after the Revolution."

first and appraise the land after serious troubles became evident. A great tragedy of Maritimes settlement has been that agriculture has been so frequently conceived as an activity that could be profitable when other enterprises failed.

Fortunately for the Loyalist settlers, other opportunities were available which, temporarily at least, prevented the hardship and destitution that could have been expected had they been dependent on farming alone. Economic conditions, aside from agriculture, were favourable in all the Maritime provinces for some years after 1783. The British Government continued its direct assistance to settlement and development by way of grants for settlement and compensations for United States losses. Energetic traders took rapid advantage of the preferred position that offered in the British West Indies trade now that the New England states were excluded from it and employment in the carrying trade flourished.

In general, the four new Maritime provinces were expected to perform the same functions in the new British Empire that the New England states had carried out previously. They would serve as a centre for shipping and shipbuilding, as a base for the North Atlantic fisheries, and as a source of provisions and lumber for Newfoundland and the West Indies (Easterbrook and Aitken, 1958: p. 142-3).

The major weakness in this was in agriculture. Farming in Nova Scotia was relatively undeveloped except in the Chignecto-Annapolis area. In New Brunswick it was almost non-existent. In Prince Edward Island it was just getting underway. It was expected that foodstuffs would still have to come in from the United States for a few years after 1783, since most of the newly arrived Loyalists were city folk and unaccustomed to the crude toil of agriculture. But the situation became disturbing when, long after the Loyalists were settled, only Prince Edward Island became self-sufficient in agriculture. All three of the other provinces continued to depend on imports of United States foodstuffs both for domestic consumption and for export to the West Indies (Easterbrook and Aitken, 1958: p. 144).

In 1807, two events boosted Maritimes development. One was the closing of the Baltic ports to British shipping following the Treaty of Tilsit. This resulted in the establishment of preferential tariffs for timber from British North America which enabled the Atlantic provinces to ship profitably almost unlimited quantities of timber to Britain. All four provinces had excellent timber resources, and for the next 40 years all four enjoyed a remunerative timber export. The other event was the United States Embargo Act which virtually prohibited all commerce from American ports. This diverted much American cargo to the carrying trade of the Maritimes. Within less than a year British American ports were handling more ships than all of the United States. Most of the cargoes were destined for the West Indies. But this advantage in the carrying trade was a special situation destined to last for less than a decade.

Together the timber traffic and the carrying trade brought to all four of the Maritime provinces an unprecedented economic growth of boom proportions especially from 1808 to the end of the Napoleonic Wars in 1815. Until 1807, they had been producing mainly white pine mast timber, especially in New Brunswick. From 1807 to 1810 New Brunswick's timber trade tripled. It continued to grow and timber became a major commercial interest, drawing its labour (often part-time) from the farms. It would have taken a quite profitable agriculture to have withstood such competition. Dependence on the British timber market quickly became the dominating feature of the New Brunswick economy and remained so for the next 40 years. In the other three provinces it also became quite important. The historic economies of wood, wind and water (timber, shipbuilding, carrying trade and fisheries) became firmly established in all four Maritime provinces in this period.

For the Maritime colonies as a whole the period from 1808 to 1815 was one of remarkable economic expansion (Easterbrook and Aitken, 1958: p. 149). At the beginning of the period, Nova Scotia and New Brunswick were little known and had made little economic progress. Their settlements were still primitive and men considered themselves fortunate if they could support their families from their farming and fishing activities. By the end of the period, fortunes were being made, capital had been accumulated and Nova Scotia and New Brunswick had become able to challenge New England in the carrying trade.

This burst of economic development resulted, it is clear, from a unique conjuncture involving positive miscalculations in United States foreign policy and British wartime expediency in obtaining timber supplies.

In the period after 1815, in Nova Scotia and New Brunswick, this economic pattern was consolidated to a considerable degree. Both became commercial colonies making their living mostly by timber, shipbuilding,1/ trade and the fisheries. Their agriculture developed very slowly, however. They depended on the United States for supplies of foodstuffs for use in the fisheries and for re-export to the West Indies and Newfoundland. Nova Scotia farmers concentrated mostly on livestock and dairy products. In New Brunswick, farming was mainly an auxiliary to the timber industry and commercial production beyond these requirements was small and infrequent. Only in Prince Edward Island was agriculture making good progress. Exports from the Island expanded with exports of wheat to England starting in 1831.

1/ Shipbuilding became a major industry, ships being built for fishing and colonial trade as well as for sale abroad. In 1849, there were 89 ships (tonnage 14,689) built in Prince Edward Island; 221 (tonnage 29,442) built in Nova Scotia; and 119 (tonnage 39,280) built in New Brunswick.

Yet the demand for food in the Maritime provinces had grown quite rapidly. The population of New Brunswick rose from 74,000 in 1824 to 194,000 in 1851, an increase of 161 per cent. In about the same period (1825-1851), the population of Nova Scotia increased from 104,000 to 277,000, or 166 per cent.1/ Large increases in population occurred also in Prince Edward Island.

Thus, with the economy booming and this rapid increase in people to be fed, the potential for agriculture was most favourable. Its failure to respond in New Brunswick and Nova Scotia has been attributed to the characteristics of the immigrants coming in from Europe, the scattering of population in small sea-coast settlements, the lack of good roads, the concentration of credit and mercantile ability on overseas trade, the prevalence of particularly poor farming practices and the absence of protection against American imports (Easterbrook and Aitken, 1958: p. 239). But this overlooks the basic limitation of poor land. Farming thrived in Prince Edward Island even though the timber trade, and fisheries flourished there also, albeit on a smaller scale.

Clearing virgin land of forest and rocks in Nova Scotia or New Brunswick was more difficult and costly than any prepara- of land the immigrants had been accustomed to in Europe. Many settlers had little previous farming experience. The result generally was a low standard of farming practices in the Maritimes. The efforts initiated by Agricola (John Young) in 1818 to improve farm practices in Nova Scotia had some long-run favourable results in all provinces, but his promotion of Nova Scotia as a "wheat country" tended to discredit the good work he initiated in other fields (see Fowke, 1946: p. 36-61).

The significant factor then in the development of agriculture in Nova Scotia and New Brunswick was similar to that of the present - the quality of the land. If large areas of good quality land had been available for farming in either province, the supporting services of roads, credit, markets and extension would have been warranted and undoubtedly developed. In other words, it was hardly sound to use revenues from other industries to support agriculture unless the farm development could be expected to add greater long-run benefits to the economy than these other industries. Yet substantial funds were allotted early in the settlement period for subsidies for clearing land (Act of 1805) for producing grain or "bread corn" (Act of 1806-07), for importation of livestock and seeds, etc., e.g., Board of Agriculture, Act of 1819) and for other purposes. These subsidy policies tended to be maintained beyond the early settlement period. Yet the generally lower incomes in agriculture enabled the timber, shipbuilding and other industries to draw off workers from the farms and seriously weaken agriculture.

Moreover, each time an economic crisis occurred in timber, shipbuilding or trade, it was agriculture that was promoted as a suitable alternative, as a means of local employ-

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1/ From 1815 to 1851, about 55,000 immigrants settled in Nova Scotia.

ment and as a way of reducing imports. This was the case in Nova Scotia at the end of the Napoleonic Wars in 1815. It occurred in New Brunswick in 1825, when timber prices fell following the stock market crisis and a slump in Britain's building activity. A similar crisis in 1842 in New Brunswick again led to new efforts to encourage farming (Easterbrook and Aitken, 1958: ch. XI). By the early 1850's the markets for square timber in Britain were declining and the supplies of good timber in the Maritimes[1/] were also growing scarce. These factors indicated the need for substitute industries to support the rural economies that had subsisted on timber. With much land now cleared of its virgin timber, agriculture was presumed to be a logical alternative.

Reciprocity with the United States, to open that market to natural products from the Maritimes, began to be given much support. Britain's actions in the 1840's and early 1850's to remove all colonial preferences, also contributed to the support for reciprocity. The period during which reciprocity with the United States was in force (1854-1866) was, except for a sharp recession in 1857, one of considerable prosperity and rapid growth for the Maritimes. Its latter years were strengthened by the outbreak of the American Civil War.

Yet the early 1860's was a period in which a number of fundamental changes were taking place in the economic structure of the Maritime environment. The Maritime colonies, which had developed as commercial colonies of an overseas empire in an age when the chief instruments of both world and local commerce were sails and wooden ships, were being significantly affected by changes in institutions and technology. Two such changes were the elimination of trade preferences by Britain and the revolution in transportation. The changes in transportation were more far-reaching - railways were in process of uniting inland communities and extending the agricultural frontier westward; steam power was in process of challenging the traditional supremacy of sail; and the iron ship was about to displace the wooden ship.[2/] Much has been written of the effects of Confederation on the Maritime economies but the basic changes were well underway before the time of Confederation. By 1860, the decline of the "wood, wind and water" economies was clearly marked. The difficulties lay in the assumption, on the one hand, that the conditions for past prosperity had been indigenous to the Maritimes and, on the other hand, that land-based industries like agriculture could fill the gap left by the decline of the industries then being undermined by the new transportation technology and the changing trading pattern.

1/ Exports of New Brunswick pine fell from 100,000 tons in 1856 to 27,174 tons in 1865.

2/ See Saunders (1939): p. 1. In 1840, steamships accounted for 14.0 per cent of the carrying capacity of water-borne commerce; in 1860, 31.5 per cent; and in 1880, 61.5 per cent.

The prosperity of the first half of the 19th century could be attributed in the Maritimes to a uniquely favourable chain of circumstances that should not ordinarily have been expected to continue.1/ The expectations that agriculture and other land-based industries could fill the big gap left by the decline of the wood, wind and water economy was not a reasonable possibility - the land resources in the Maritimes were simply not adequate at that time.

The decline of the wood, wind and water industries in the Maritimes was accentuated by the loss in trade that followed the ending of the American Civil War in 1865. This decline in trade continued over the next 30 years. Major efforts were made to direct economic activity into other industries as resources were released from the timber trade, shipbuilding and the carrying trade. Surplus labour tended to be directed into farming and fishing, with some expansion also into mining, particularly coal. Surplus capital was directed into small industry, particularly textiles and other small manufactures.2/

A great effort was made at this time to convert agriculture into a major industry, giving special attention to the expansion of potato and apple production. A substantial industrial adjustment, especially in the shift toward agriculture, was effected during the recession that occurred between the 1870's and about 1896. However, another coincidence of circumstances again brought prosperity for a few years and again diverted the direction of economic development.

The remarkable expansion of immigration and pioneer settlement of the Great Plains of North America from 1895 to 1914 initiated this great wave of prosperity in Canada. The World War of 1914-18 magnified it. The Maritimes were able to ship apples and potatoes to the new Prairie settlers by the carload. Iron and steel production had been initiated in Nova Scotia in the 1880's and with the growth of railroad building and, later, the demands of the War, that province enjoyed a boom up to 1913 such as it was not to enjoy again3/ until World War II. Textiles and other small manufacturers also thrived in this period, 1896 to 1920.

1/ "This unprecedented prosperity of the age of wood, wind and water was something like the falling of crumbs from other tables, the consequence of the abounding expansiveness of the world economy of the 1850's" (MacNutt, 1967: p. 267).

2/ The New England economy was similar and was similarly undermined by the same economic forces. But the New England traders shifted their capital more extensively into such operations as textiles and similar production while the farmers left New England to move westward to more salubrious agricultural conditions, abandoning their farms in New England to the forest (see Cole, 1926).

3/ Pig iron output in Nova Scotia rose from 19,008 long tons in 1889 to 428,632 long tons in 1913. By 1922, it was down to 120,769 tons. (Saunders, 1939: p. 115.)

For the Maritimes, the prosperity of those 25 years came to an abrupt end soon after the Armistice in 1918. In the 1920's, Canada's period of rapid expansion was ending and the markets provided by Prairie settlement had declined accordingly. Demand for Maritime potatoes and apples in the West had dropped sharply. Competition for the apple market in Britain became keener. Demand for Nova Scotia's steel shrank rapidly after the War. During the 1920's, the forest industries languished. Fish prices declined greatly, and conditions in the fisheries became acute. Agriculture in general was experiencing its first major difficulties with the new technology. The increasing use of motor vehicles was decreasing the demand for horses and hay, and areas like the Tantramar marshes suffered. Railway transport and refrigeration were bringing meat from other parts of Canada to compete with local beef. The shift in the forest industries from lumber to pulp and paper at this time disorganized the traditional timber and farming combination that had enabled many farmers to survive as long as they had.

The difficulties of the 1920's led to the appointment of the "Duncan Commission" in 1926. Again subsidies were the recommended solution. Unfortunately, the subsides were not directed toward expansion of more profitable industries but to the support of unprofitable and declining industries.

A review of the basic industries of the Maritimes in the period prior to World War II shows that agriculture, mining, fishing and lumbering were the major supports of the economy, along with some manufacturing.1/ Of all these, agriculture was the most important.

Yet all four basic industries were low-income industries in the Maritimes. Agriculture was ordinarily a low-income industry because most farms were too small in scale and the land quality was too poor to provide satisfactory incomes. Fishing was ordinarily a low-income industry because of its seasonality (usually a relatively short season), its uncertainty and low prices, and the difficulty of providing reasonable educational and other social services in the isolated fishing communities.2/ Coal mining was ordinarily a low-income industry because the

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1/ "The economy of the Maritime provinces rests upon four cornerstones: agriculture, mining, fishing, and lumbering. Supported by these cornerstones is a light structure of manufacturing industries" (Saunders, 1939: p. 59.)

2/ A study of fisheries employment shows that workers usually go into the primary fisheries in periods when little employment is available elsewhere. Fisheries employment tends to decline when employment in other industries is available. Incomes in the fisheries in the Atlantic provinces tend to support these movements of workers.

seams were too thin for effective mechanization and productivity was accordingly low. Lumbering was ordinarily a low-income industry because the timber resources had become depleted and thus production tended to be high in cost relative to competing areas such as British Columbia.

For the workers, incomes on the average tended to be low, seasonal and uncertain whether they were in farming, fishing, mining or woodswork. Because incomes were so low, it was fairly common practice to combine two of these enterprises as a means of making a livelihood. In all three provinces in this pre-World War II period there was much farming and fishing combined and also much farming combined with forest work. The opportunity for farming and mining was less widespread but quite common on Cape Breton Island and Nova Scotia's north shore.

This tendency toward combinations of disparate enterprises was related partly to the need for additional income and partly to the lack of good quality land for farming. It largely eliminated the possibility of specialization in farming and the benefits that went with specialization. The traditional emphasis in the promotion of farming had usually been on diversification, that is, mixed farming, to avoid "putting all your eggs in one basket". Some specialization could be effected with diversification of the mixed-farming type, but when it was carried into two separate and distinct industries not only were the gains of specialization lost but there was frequently a deficiency of capital inputs because the limited capital had to be spread over two different types of enterprises.

It is enlightening at this point to examine the conclusions of Saunders (1939) on the characteristics and trends of the agricultural industry of the Maritime provinces 30 years ago. The interesting feature of these conclusions is that their implications have too often been ignored in agricultural policy. Professor Saunders' summary of the characteristics and trends of Maritime agriculture follows:

1) Agriculture in the Maritime provinces is a mature industry. The more suitable farm lands have long since been settled, and the process of abandoning the less suitable areas has been carried far. Within recent years, the opening up of new territory suitable to agriculture has been important only in New Brunswick.

2) Only a relatively small part of the land of the Maritime provinces is arable, and the best of this arable land is, for the most part, concentrated in relatively few favoured spots. This results in a high degree of concentration of agricultural production.

3) In general, the topography of the country, even in the better agricultural areas, militates against extensive farming by placing limits upon the use of machinery. In the less favoured areas, the amount of agricultural land available on each farm is usually extremely small. The result is that the entire region bears the aspect of a land of small farms.

4) The agricultural industry of the Maritime provinces is closely dovetailed with a number of other industries, that is to say, farming is often combined with fishing, lumbering, mining or some other occupation.

5) The relative isolation of some of the small farming communities and the extensive practice of combining one or several other occupations with farming make difficult a high degree of efficiency in farm management and the adoption of new and approved agricultural practices.

6) The character of the soil and available markets favoured the production of roots, fruits, and dairy products. There has been a degree of specialization in each of these three branches, but the typical farm in the Maritime provinces is still a mixed farm.

7) The two important cash crops, apples and potatoes, have developed in response to the demand of outside markets and are therefore in an exposed position, being subject not only to outside competition but also to the vagaries of the tariff policies of many countries.

8) In many agricultural commodities the Maritime provinces form a deficiency area. They have long been dependent upon outside sources for most of their wheat and wheat flour, and for some time the production of butter, cheese, eggs, and meats, has fallen far short of the total requirements of the region.

9) The circumstances under which farming is carried on in many parts and the existence of a large number of very small producers militate against the production of a high-quality product; and make it difficult to organize the marketing side of the industry, difficult to improve production standards, and, consequently, difficult to increase the monetary returns in the less favoured areas. (Saunders, 1939: p. 68-9.)

Much the same kind of conclusions were being drawn as far back as the 1760's after settlement of most of the better lands had been completed in Nova Scotia and Prince Edward Island. Similar conclusions have been drawn whenever a sound appraisal of agriculture's comparative advantage is made - the land is found to be relatively low in fertility, arable cropland is scarce, and it is difficult to get enough land of suitable quality together in many areas to make a large enough farm enterprise to be fully profitable. Yet, in the past, when there was a demand for settlement, the need for such appraisals was usually ignored. Thus, in the 1780's, thousands of Loyalists were settled for farming on lands quite inadequate for making a living. Again in the recession after 1815, emphasis was put on agricultural settlement and expansion, and again abandonment followed. So also after 1860 in the recession following the decline of the sailing ship, economic policy was directed toward agricultural settlement and improvement. Finally, in the depression of the 1930's and after, resettlement was again advanced as a central policy1/ and again abandonment occurred, particularly in the postwar period, especially from 1955 onward.

Thus, in the past, settlement or resettlement of land for farming and its subsequent abandonment has become a traditon in the Maritimes, but particularly in Nova Scotia and New Brunswick. Such settlement or resettlement was usually designed to promote special economic purposes - to relieve unemployment in recessions, to promote particular domestic production and to induce Maritimers to remain at home rather than seek employment elsewhere. In the past these agricultural policies could be applied without imposing serious disadvantages on the people involved in the settlement. By 1967 this was no longer possible. Today two kinds of technological developments have made such policies escessively disadvantageous.

1/ See, for example, Nova Scotia Economic Council (1938): Vol. III, p. 15, where it states: "Whenever a large surplus population arises due to unemployment or any other cause it is commonly suggested that it should be taken care of through land settlement. Frequently, however, this suggestion is made with little regard to the cost of settlement, to the ability of those out of work to become farm operators, to the availability of land properly suited to agriculture, or the position of those already engaged in farming. Such suggestions were widely made during the recent depression and plans based on them were hastily drawn up in 1932. As a result Nova Scotia and several other provinces were saddled with elaborate land settlement schemes undertaken as unemployment relief measures. The results, almost without exception, have proved unsuccessful."

One of these is the technological revolution in agriculture, particularly since World War II, which has given such great advantage in cropping to large farms that are sufficiently level, stone-free and productive to warrant using large-scale mechanized equipment and other advanced technology. The other is the explosive growth of employment in the manufacturing and other industries in the last two decades which has opened highly remunerative alternative employment to those in the low-income sectors of industries like agriculture, fisheries and mining.

The significance of these developments for the future of Maritime agriculture is explored in later sections of this report. Here there remains only to summarize the effect of the historical foundations on current agriculture.

A great many traditions, institutions and patterns have been carried forward from the past into Maritimes agriculture. Many of these continue to influence the pattern and rate of change. The influences from the past may be more evident in the Maritimes than in younger provinces because the economic advantage of change has been less strong in the Maritimes.

It has been traditional in the Maritimes to settle farmers on land that has not been adequately appraised as to its productive capabilities. This has resulted in much land being settled for farming that should never have been cultivated. It has resulted in most farms being too small and too poor in soil quality to produce a satisfactory living for the farm family. This makes it difficult today to acquire a farm of a satisfactory scale except in an area where farm abandonment has been extensive.

It remains traditional in the Maritimes to subsidize land improvements on poor land to increase its productivity. Perhaps this was some compensation for not having granted the settler enough land in the first place.

It has been traditional to promote agriculture in the Maritimes when other industries were in decline rather than to promote it only on its own merits. As a result, agriculture in the Maritimes has suffered from an excessive movement in and out of farming and has failed to build on a foundation of profitable types and scales of farm enterprises.

It has been traditional to continue agricultural policies without adequate appraisal of their economic implications. If adequate examination had been made of the profitability of particular types of farms and farming, undoubtedly farms would have been larger and more specialized than they had become up to World War II.

It was traditional to combine farming with fishing, timbering or mining in all three provinces in earlier years.

More recently it has become evident that this was compatible only with a low-income agriculture. Moreover, the additional requirements for capital inputs for the second enterprise and the losses due to lack of specialization virtually ensured that incomes would remain low. In recent decades this combination of farming with other enterprises has declined to negligible levels.

It has been traditional to promote mixed farming or diversified agriculture in the Maritimes. This was because it was thought that diversification reduced the risk and uncertainty. But under current conditions it is also evident that diversification reduces the opportunities for increasing the farm income by specialization and in many cases virtually ensures that incomes will remain low.

It was traditonal in many cases to have a number of small widely-scattered producers of a product, each producing the particular kind and quality of a product that he preferred. The result was that the marketing of such products was frequently difficult and costly because the quality of the product tended to be uneven, undependable and generally poor; the cost of gathering the product from many small widely scattered producers tended to be high even after roads were generally available; it was difficult to obtain an adequate marketing margin without forcing farm prices down to unduly low levels or obtaining an unusually high price from domestic or foreign buyers.

It has also been traditional to overlook making effective appraisals of the market possibilities, including such market disadvantages as those noted above. It was more traditional to accept these market or production disadvantages as a burden to be borne then to acknowledge that these disadvantages frequently precluded profitable farming operations.

It was traditional to believe that because a particular farm product was imported from other Canadian regions or from the United States that it could be profitably produced in the Maritimes. Moreover, it has been traditional to view the volume of imports of farm products into each province as the potential for expansion of agriculture in that province.

It has been traditional to have relatively small rural municipalities, each with few people and a small tax base. This tended to create difficulties whenever rural incomes fell or when farms were abandoned.

It is perhaps desirable at this point to note the important connection between rural poverty and deficiencies in social services. In rural areas, where incomes tend to be low or where a substantial part of the farms have been abandoned, it becomes difficult to provide adequate social services (education, roads, churches, health and other services). As these difficulties multiply, the social services decline and thus the

ability of the people to help themselves also deteriorates. These difficulties in providing adequate rural social services were multiplied because the local municipality was ordinarily too small and its resources too limited to provide adequate services. Generally, the smaller the municipality, in such circumstances, the more help it needed from the province to overcome its handicaps in local social services. But provincial assistance for social services was seldom allotted in this way.

5. INFLUENCES FOR CHANGE IN CANADA'S POSTWAR AGRICULTURE

The late 1930's mark a notable turning point in the agriculture of Canada and of the Maritime provinces. By the beginning of the war of 1939-1945, major new influences were at work changing the pattern of farming in Canada. These new influences were eventually to have far-reaching effects on agriculture in the Maritime provinces.

Farming in the Maritime provinces, in its first two centuries of development, had tended to adapt itself to the available resources of the region and to the economic and technical environment of the Canadian economy. The regional resources have remained relatively constant but their Canadian environment has changed greatly in recent years. In the two decades following the war of 1939-1945 the agricultural environment in Canada has passed through a remarkable metamorphosis. The result was a revolution both in the techniques and in the organization of Canada's agriculture. Many of these changes, which will be examined below, have tended to place the traditional small-scale farm at an increasing disadvantage while giving substantial advantages to the larger-scale farm enterprise. It is necessary to perceive the significance and sequence of this revolution in farming to appreciate the remarkable changes which later resulted in Maritime farming.

Influences for Change

The revolution in farming was the result of a twofold change in the environment. On the one hand, there was an improvement in the economic environment related to higher and more stable prices and to a reduction of other farm risks. On the other hand, there was remarkably rapid improvement in technology. Either one of these influences by itself would have wrought a substantial change in Canada's farming. Together they fashioned a major agricultural revolution in the two decades following the war of 1939-1945. Yet this revolution was to spread unevenly through Canada's agriculture. Its impact was earliest and strongest in those regions having large areas of fertile land suitable for large-scale farming. Its influence was latest and least on those areas where the land was rough, low in fertility, poor in drainage or generally unsuitable for large-scale farming.

The war of 1939-1945 provides an appropriate demarcation line between the old farming and the new. Up to that time, the traditional character of farming remained dominant - small farms, using mainly animal power, with uncertain yields and low and variable incomes. Influences for change, such as mechanization, had begun to take effect to a limited extent by that time. A few government programs to reduce farm risks had also been instituted by that time but their influence was still small. During and after the war of 1939-1945, other strong new influ-

ences supplementing those already operating, began to impinge on the agricultural industry. Together their influence became a dominant feature of the revolution that followed.

The remarkable transformation that occurred in farming in the postwar period was the product of this diversity of influences. Significant among them was the addition of public measures designed to reduce the uncertainties of yields and prices. Another was the influence of low farm incomes combined with that of attractive non-farm employment which drew farm people away from the land and thus stimulated the consolidation of farms into larger-scale units. Special financial resources became available in the immediate postwar period to smooth the path of the transition. Changes in the demand for farm products also influenced the nature and scale of farming. The postwar developments in new technology and mechanization together with the availability of financial resources to bring them into use were both an inducement and a means for farmers to change and improve their enterprises.

Public Measures to Reduce Uncertainty

Before agriculture could make substantial improvements with confidence it had become necessary that the uncertainties of farm yields and prices be moderated. Until the 1930's, it had not been widely recognized that government could play an important role in reducing these uncertainties. During the 1930's, low yields and low prices in the Prairies coincided with a general depression in the rest of the economy and forced poverty on most farm families. It was only after this farm crisis that governments began to extend their participation beyond the traditional services of demonstrations, physical research, grading and extension that had characterized public activities in the past. The new measures were designed to modify price and yield uncertainties and to improve the use of land. The first was initiated in 1935.

To appreciate the significance of these public measures one must be aware of the extent to which risk and uncertainty dominated farm enterprises prior to the 1940's. Risks of sharp declines in the prices of farm products were an accepted element in the farm outlook up to the 1930's. Sharp variations in yields were common. Partial or complete crop failures (due to drought, soil drifting, grasshoppers, cutworms, hail) were frequent in the Prairies. A measure of these risks in that pre-1940 period is given by the substantial withdrawal of commercial institutions from farm financing in the western provinces. Moreover, because of these price and yield risks, farmers who otherwise had opportunities for expansion and improvement had little or no confidence that they could repay the borrowed capital needed to implement the changes in their operations. The opportunities in mechanization and new technology that were already offered in that period had to be set aside by farmers because the risk of low incomes was so great.

These special conditions in Prairie farming that occurred in the 1930's led to emergency action by both federal and provincial governments. These special public measures, begun as emergency programs, have since become established and extended into a rounded program for the reduction of risks in other regions.

A major risk in crop yields lay in inappropriate land use. In the enthusiasm of Prairie settlement, much semi-arid land suited mainly for grazing purposes was allowed to pass into grain-cropping uses.1/ The risks of drought, soil drifting and low incomes on such lands were high. Under the federal Prairie Farm Rehabilitation Act of 1935, federal and provincial governments took action to divert these lands back to grass in the Prairies. The program, financed to a large extent by the federal government, promoted improved cultural practices, soil and water conservation and community pasture development. Some 7 million acres were shifted into community pastures. This encouraged diversification by the surrounding farmers into cattle grazing. The contribution of this program to the stabilization of agriculture in the Prairies was very great, and its significance was later recognized. It provided the foundation for the Agricultural Rehabilitation and Development Act, passed in 1961, which provided for a similar but more extensive rehabilitation plan for farming areas throughout Canada.

A second major step was taken in 1939 when the Prairie Farm Assistance Act was implemented by the federal government. This act provided for payments, financed partly by farmer contributions, to Prairie farmers when their crop yields dropped below an established minimum. As a limited type of crop insurance, this measure moderated greatly the harsh risk of complete crop failure.2/

1/ A similar pattern occurred in central and eastern Canada, but the adjustment in those regions was slower and only in the late 1950's and 1960's was it to become of substantial significance.

2/ Later the Federal Crop Insurance Act of 1959 provided for more comprehensive coverage of crop risks by the provinces with the federal contribution covering mainly administrative costs and a portion of the risk. The relatively high cost to the farmers or provincial governments of the remaining risk was a factor which limited the coverage of the 1959 act mainly to small trial areas, until recent years.

It was in this period also that public policy was first directed effectively toward the reduction of uncertainties of farm prices. For primary industries like agriculture and fisheries, comprised of a large number of small producers, price uncertainties had long been a major deterrent to positive development and improvement of enterprises. In agriculture, price uncertainty was related not only to fluctuations arising from an unresponsive and changing demand and a fluctuating and uncertain supply, it was related also to the inability of individual farmers to control either total output or the orderly flow of that output to market. In consequence, both the structure of the farming industry and the organization of markets contributed to conditions in which seasonal, cyclical, chance and other price fluctuations flourished. Moreover, the impact of these price fluctuations was amplified by the burden of heavy fixed costs which resulted in farmers' net incomes fluctuating even more widely than their cash incomes.

The farmers' own efforts, first through government regulation and later through co-operatives, had improved the farm market organization, but they were not successful in achieving stable prices. Farmers' experiences in the depression of the 1930's demonstrated that their own efforts were inadequate for this task. Farmers had been pressing for years for government action to co-ordinate their marketing and establish greater price certainty.[1/] But it was not until 1935 that concrete public action was taken. The basic step was the establishment of the Canadian Wheat Board in that year, for the "marketing in an orderly manner ... of grain grown in Canada". In the beginning, the Wheat Board received grain on a voluntary basis from farmers and confined its operations to wheat only. In 1943, it was given compulsory control of the marketing of western grains and this compulsory control was retained for wheat after the war. In 1949, it was extended to oats and barley.

The Wheat Board made a major contribution to price certainty. First, it provided an assured price in advance of seeding the crop. This was accomplished by the Board announcing a government-guaranteed initial payment early in the crop year. Secondly, the Board stabilized and probably raised selling prices through its strong market control and orderly marketing of the farmers' grain. The evidence of this stability is found in the steadiness of grain prices in the 1950's and early 1960's.

1/ Galbraith (1952), in his excellent analysis of this phenomenon in the United States, examines agrarian pressure in terms of a sequence of three stages - early support by farmers of monetary inflation, late 19th century emphasis on regulation or control of firms with whom farmers did business, and finally group marketing action which, when co-operatives proved not fully effective, took the form of a demand for government co-ordination. Evidence of these three stages in Canada's farm history is notably clear.

A second major contribution to price certainty was made through public action on commodity agreements. Wheat agreements had been put into effect after the end of World War II, first by the United Kingdom Wheat Agreement and later by successive International Wheat Agreements. Both provided a minimum price for wheat exports. For numerous other farm products, primarily sold in domestic markets, marketing boards and commodity agreements under both federal and provincial legislation have similarly contributed to stabilizing farm prices.

A third step in price certainty was the federal price support program established in 1944. Developed in the beginning to provide price support only in emergencies, it was gradually extended to provide standby support for most major farm products. This was further expanded under the Agricultural Stabilization Act of 1948, when deficiency payments were adopted for some products in place of government purchasing methods. Such price support has, with a few exceptions, been an effective instrument for stabilizing prices and guiding the price-based decisions of farmers. In 1966, the products covered by price support included eastern wheat, oats and barley, cattle, sheep, hogs, butter, cheese, eggs, soybeans, wool, manufacturing milk and cream, honey, sunflower seed, turkeys and beets.

These public measures to reduce the uncertainty of yields and prices were supported by the growing contributions to yield certainty provided by new technology in the form of mechanization, fertilizers, and pesticides. Together these gave farmers a new degree of confidence in the outcome of their operations. They eliminated much of the feast or famine that had dominated farming in the past. They greatly stabilized farmers' incomes from year to year. Together, the new conditions of price and yield certainty and the opportunities for technological innovations combined to create a remarkable new environment for positive improvement and adjustment that had not been evident in Canadian agriculture before.

Thus the stage was set for the transformation of a major part of Canada's farming operations into more effective and productive enterprises, provided the necessary re-allocation of agricultural resources could be accomplished. Fortunately for this, other influences were at work which facilitated this adjustment and helped re-allocate farm resources.

By the early 1940's, farms in Canada were, in the main, still too small in scale to gain very great benefits either from the new opportunities in technology or from the new advantages in price and yield certainty. These new benefits accrued mainly to those farmers who were able to expand their scale of farming operations. In the case of cropping enterprises, this expansion of scale commonly involved obtaining more land and more efficient mechanical equipment to farm it. In the case of livestock enterprises it might involve obtaining more grazing land or specializing in larger-scale, mechanized feeding operations, or both.

In the aggregate, the opportunities for more profitable farming enterprises lay in accomplishing a massive shift in the allocation of resources toward more land and more capital, but less labour, per enterprise. The major shift of resources that occurred in the postwar period would have been accomplished more slowly but for several important influences which facilitated the adjustment. The most significant of these influences were low farm incomes, alternative opportunities, a new availability of financing and changes in the demand for farm products.

Low Farm Incomes and Alternative Opportunities

Low farm incomes can be a pervasive and persistent influence inducing farmers to change, provided alternative opportunities for improvement are available. Such opportunities were available to farmers in the period following the Second World War. Two alternative opportunities were open to low-income farmers at that time. One was to improve their situation by seeking higher incomes in non-farm employment. The other was to remain on the farm but expand the farm enterprise so it would yield a higher income. The influence of low farm incomes operated in both these directions and the effect depended upon the relative difficulties encountered in the alternative adjustments.

The evidence indicates that non-farm incomes were a potent influence in the adjustment. Incomes in agriculture were low in relation to non-farm incomes, and less buoyant. Farm incomes, only 64 per cent of non-farm incomes during the war, rose more rapidly than non-farm incomes in the immediate postwar period. But while still well below non-farm incomes, they levelled off in the 1950's while non-farm incomes continued to rise significantly (Table 5-1).

In the five years 1958 to 1962, the incomes of Canadian farm workers again averaged only 67 per cent of non-farm workers.

For farm workers who were willing to move, the change to non-farm employment thus offered prospects not only of immediate income improvement but also of greater future increases in income. Moreover, there was a strong demand for workers in other industries. This meant that farm workers could usually obtain non-farm employment without the costly waiting for a job that was common in the past. From 1946 to 1966, employment in the non-farm sector increased by over 88 per cent (Table 5-2). In the same period, farm employment fell by 54 per cent. The rapid growth in employment in construction and service industries in particular, offered ready opportunities for farm people who were prepared to move to higher-income jobs elsewhere.

In addition, there was a widening disparity in wage rates. Farm wages, which in 1946 averaged about 59 per cent of non-farm wages, had by 1960 dropped to 48 per cent. This was further evidence of low incomes in farming but it also meant greater difficulty in obtaining competent hired help. Farmers'

TABLE 5-1

Average Income Per Worker, Farm and Non-Farm, Canada, 1941-1962

Year	Farm Income	Non-Farm Income*
	$	$
1941	475	1,086
1942	988	1,220
1943	802	1,364
1944	1,101	1,432
1945	855	1,457
1946	1,007	1,460
1947	1,121	1,638
1948	1,533	1,869
1949	1,434	1,976
1950	1,335	2,049
1951	2,224	2,316
1952	2,339	2,512
1953	2,106	2,632
1954	1,342	2,663
1955	1,761	2,726
1956	2,089	2,939
1957	1,637	3,009
1958	2,093	3,005
1959	1,968	3,178
1960	2,197	3,135
1961	1,782	3,265
1962	2,627	3,344

* Non-farm labour income used here is total income less wages and salaries in agriculture, fishing and trapping.

Source: Farm Income and Canadian Statistical Review. D.B.S.; Trends in the Agricultural Labour Force in Canada, Dept. of Labour, 1960.

sons were less willing to hire out at these low farm wages. Farmers could no longer compete with the urban labour market for the experienced hired help they had been accustomed to employing. This was a major influence toward greater mechanization.

These extensive opportunities for employment elsewhere, plus the prospect of higher and rising incomes in the non-farm sector, were strong influences urging farm families to move from their low-income farms. The rapid movement of workers from farms in the 1950's (Table 5-2) illustrates the force of this influence.

TABLE 5-2

Employment, Farm and Non-Farm, 1946-1966

Year	Farm Workers	Non-Farm Workers
	000	000
1946	1,186	3,500
1951	939	4,178
1956	776	4,826
1961	674	5,375
1966	544	6,609

Source: Census of Canada.

Yet it should not be assumed that it was those with the lowest incomes that moved most readily to non-farm employment, thus gradually improving the average income level in agriculture. On the contrary, those with the lowest incomes ordinarily did not have sufficient funds to underwrite the costs of moving and getting established. Observation of the mobility pattern indicates that it was more commonly those with intermediate farm incomes who had the funds and initiative to shift most readily. This was significant. It meant that the most extensive departure from the land was frequently from the areas where incomes were only moderately low. In those farm areas where incomes were lowest the influences for change tended to be weaker and were commonly quite inadequate to stimulate mobility; in such areas incomes tended to remain low and, in many cases, to decline. The increasing evidence of these pockets of agricultural poverty in Canada was the incentive for the farm rehabilitation legislation (ARDA) passed in 1961 and later extended, which was designed to provide special assistance to enable disadvantaged, low-income farmers to improve their incomes on the farm.

For those farmers with initiative and ability, seeking non-farm employment was not the only alternative. The other was to expand their farming operations and thereby increase their incomes on the farm. In many farming areas, competent farmers were given an opportunity to do this. For some, the opportunity lay in obtaining more land to expand their operations. Fortunately, the movement of farmers out of agriculture released land for these farmers to combine with their own into larger units. For others, the opportunity lay in increasing the capital applied to their existing operations, that is, by specializing in poultry, dairy or livestock feeding operations, for example.

Only a few farmers were able to lift themselves much above the low-income category by either of these means. Most farmers were destined to remain at quite low income levels. The overall change in this farm income pattern can be broadly illustrated by census data on the number of farms classified by the value of products sold (Table 5-3). The total number of farms in 1951 (623,000), had decreased to 481,000 in 1961, and to 431,000 in 1966, a total decline of 31 per cent. Farms with product sales below $3,750 comprised 77 per cent of the total farms in 1951 and 47 per cent in 1966.1/ Biggest decrease was in farms with product sales below $1,200, which dropped from 236,000 in 1951 to 127,000 in 1961, to 92,000 in 1966, but they still made up 21 per cent of the farms in 1966. Only 29.2 per cent of Canada's farms had product sales of $5,000 or over in 1961, against 44.6 per cent in 1966. The farms with sales between $1,200 and $4,999, decreased from 213,033 in 1961 to 145,894 in 1966 and comprised 33.9 per cent of the farms in the latter year.

TABLE 5-3

Number and Percentage of Farms, By Value of Products Sold, 1951, 1961 and 1966

Value of Products Sold*	Number of Farms			Percentage of Farms		
	1951	1961	1966	1951	1961	1966
$	no.	no.	no.	%	%	%
35,000 and over)	)	9,507	10,282)	)	2.0	2.4
25,000 - 34,999)	8,649)		9,384)	1.4)		2.2
15,000 - 24,999)	)	14,411	31,149)		3.0	7.2
10,000 - 14,999	12,594	25,923	44,217	2.0	5.4	10.3
7,500 - 9,999	18,984)	90,419	38,753	3.1)	18.8	9.0
5,000 - 7,499	50,035)		58,103	8.0)		13.5
3,750 - 4,999	53,162	49,754	37,923	8.5	10.3	8.8
2,500 - 3,749	91,666	69,023	47,024	14.7	14.4	10.9
1,200 - 2,499	151,290	94,256	60,947	24.3	19.6	14.2
250 - 1,199	148,962	82,946	55,271	23.9	17.2	12.8
50 - 249	87,057	43,850	36,692	14.0	9.1	8.5
Institutional	692	814	777	0.1	0.2	0.2
Total	623,091	480,903	430,522	100.0	100.0	100.0

* Value of products sold refers to value of farm products sold in the 12-month period preceding June 1. Changes in price levels affect these values. Thus, values of farm products in the 1951 Census were relatively higher than in the 1961 Census. The price index in 1950-51 averaged 252.6 against 225.8 for 1960-61.

Source: Census of Canada.

1/ Net income can be estimated from product sales by deducting 55 to 65 per cent for operating and depreciation costs. Thus product sales of $3,750 might be expected to yield about $1,300 to $1,700 in net income.

Viewing the influence of low incomes as a whole on the transformation of agriculture, it may be observed that its two primary effects tend to complement one another. Some farmers, seeking better income opportunities elsewhere, left their farms to improve their positions and in leaving released their resources to those who remained in farming. The latter, seeking to improve their incomes within agriculture were able to do this to a degree by expanding, reorganizing and mechanizing their farming operations. Thus the low incomes of farmers, combined with the alternative opportunities for improvement, become a powerful influence toward change and adjustment in agriculture.

Special Financing Resources

The special financing conditions which existed in the immediate postwar period facilitated these major structural changes in agriculture. Several features make the influence of these conditions unique in the immediate postwar period. One feature was the supply of accumulated savings that farmers and others had built up in their forced savings during the Second World War. A second was the rapid relative increase in farmers' incomes that resulted from the strong demand for farm products after the end of the War. A third was the extensive government financing under the Veterans Land Act settlement program. Together, these provided, for a few years, a volume of new financing which was probably greater than farmers had ever previously enjoyed.

Net farm income from 1946 to 1952 averaged $600 million a year, 74 per cent higher than it had been during the War years. This increase in farm incomes was due largely to farm prices rising more rapidly than farm costs.1/ After 1952, farm costs continued to rise while product prices fell off substantially.

The Veterans Land Act supplied over $120 million in farm financing in the six years 1945 to 1950. It enabled many young farmers to become established in agriculture on favourable terms but it also financed the consolidation of many farms that were released by retiring farmers. In the same period, the Canadian Farm Loan Board loaned only $22.8 million. Financing under the Farm Improvement Loans Act was just starting to expand.

This special availability of financing in the immediate postwar period was undoubtedly a necessary condition for initiating the transformation of agriculture that followed. Mainly temporary, these supplies of funds permitted adjustment in the farming industry to gain an impetus which supported changes through the 1950's and into the 1960's. The changes in farming

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1/ The index of prices paid by farmers rose from 126.6 in 1942 to 229.8 in 1952. Index of prices received by farmers rose from 127.1 in 1942 to 268.6 in 1951 and fell to 250.2 in 1952.

continued even though conditions became less favourable, especially in financing from farm income, after 1952. The adjustments in the preceding seven years indicated how rapidly farmers tended to improve their enterprises when substantial financing was available.

Changes in Demand

The structure of farming has been greatly influenced by changes in the demand for farm products. In this context, it is the persistent or long-term changes in demand that are significant, not the short-term demand fluctuations. One example of such long-term changes was the gradual but substantial increase in the demand for beef cattle. Consumption of beef in Canada rose from 613 million pounds in 1951 to 1,240 million pounds in 1957. The result was an increase in demand for grazing lands and for more feedlot operations. This higher demand for beef had, in consequence, enabled some of the abandoned farm lands of low quality to be diverted to grazing uses. It opened new opportunities in cattle feeding, leading to expanded feedlots and numerous new, large-scale, specialized feedlot enterprises. These large-scale specialized operations had also extended into other farming enterprises - broiler feeding, egg production and hog feeding, for example.

Another new development in demand was a major factor in these trends. This was the growing insistence of consumers, as reflected in large chain-store demand, that supplies of food products should be consistently dependable and of high quality. The new emphasis in consumer demand was stimulated by higher incomes, increased urbanization and the mass-buying approach of the chain food stores. Chain stores began to insist on being provided with dependable year-round supplies of high-quality food products. They offered both a large market and a premium price to those producers who could meet their quality and quantity requirements. These requirements could not be readily met by the varying qualities and uncertain quantities that ordinarily may be expected from a large number of small farm producers working independently. They could be more dependably met by large-scale specialized producers.

This emphatic demand for high-quality produce in steady volume has become a major factor, along with greater efficiencies in production techniques, in stimulating the development of quite large-scale farming operations. In central Canada, by the early 1960's, this development was well advanced - specialized enterprises were producing 100,000 broiler turkeys a year, 2,000 or more hogs, 5 million eggs, 3,000 or more fed cattle, or large acreages of vegetables or other crops. In recent years, these large specialized operations using little land were being developed more in western Canada also. They represented a new, capital-intensive adaptation of advanced technology and efficiency in the production of food products.

Technology and Mechanization

The new environment in which farmers found themselves after the Second World War encouraged them to take advantage of the adjustment opportunities it offered. The public measures instituted to reduce the uncertainties of yield and price had moderated the risks of expanding their operations. Low farm incomes and attractive off-farm employment released the land needed for expansion. From several sources temporary flows of financial resources fortuitously coincided in the immediate postwar period to provide the means for the transformation. Changes in demand and the high cost of hired labour offered special profit inducements for those who could shift to larger-scale, lower-cost, mechanized operations. This was a most favourable environment for farmers who could shift to larger-scale enterprises and many farmers moved rapidly forward with changes and improvements.

But even as farmers moved forward in this new environment, a major advance was also taking place in the availability of technical improvements and the combined effects were far-reaching, both on the organization of farming and on its financing.

The application of mechanical power was a major element in this technical transformation. Horses were still widely used for farm power until the Second World War. They were virtually eliminated from tillage operations in the two decades that followed. This released for cash-crop uses much land formerly used for horse feeds.

The smaller, more powerful and more flexible tractors that became available in the late 1930's opened the way for widespread use of effective mechanical power on most cultivated farms. The improvements in tractors after World War II, through dieselization, more powerful motors, etc., reduced their operating costs and extended their capacity, especially on farms with large acreages. There were 159,792 tractors on farms in 1941. This number had more than doubled by 1951 (Table 5-4). By 1961 farmers had 550,000 tractors, nearly 3.5 times the 1941 total, and 1.4 tractors for every farm reporting tractors. By 1966, they had almost 600,000 tractors and 1.6 for every reporting farm.

The increase of electric power was even more rapid. Electric motors on farms multiplied almost eight times, from 58,000 in 1941 to nearly 445,000 in 1961.

To utilize this new availability of mechanical power, farmers purchased larger and more efficient machines. Equipment for tillage, harvesting, spraying, milking, haying, and other operations became larger in capacity and more effective. Mechanized feeding equipment for specialized dairy, poultry, beef cattle and hog enterprises came into use to attack a major bastion of drudgery and inefficiency in farm labour productivity.

TABLE 5-4

Power on Farms

Year	Tractors	Electric Motors
	no.	no.
1921	47,455	n.a.
1931	105,360	18,639
1941	159,752	58,192
1951	399,686	196,681
1961	549,789	444,507
1966	598,483	n.a.

Source: Census of Canada.

By this new technology farmers were offered profitable new opportunities to increase the productivity of their labour. Their risks were reduced by having tillage, harvesting and other farm operations carried out more quickly and at the most appropriate time. As a result, it was possible to expand more confidently into larger-scale farming. Yet while farms grew larger, the new mechanization permitted the larger farms to be operated with less labour per farm than before. This trend was particularly marked in the Prairie provinces where workers per farm fell from 1.54 in 1951 to 1.37 in 1961. The average size of Prairie farms increased from 498 acres to 609 acres in the same period.

Offsetting, in part, this decrease in labour requirements was a substantial increase in the cost of machinery investment. From 1941 to 1951, farm investment in machinery and equipment increased more than threefold, from \$596 million in 1941 to \$1,933 million in 1951 (Table 5-5). From 1951 to 1966, it almost doubled to \$3,552 million. Part of this increase may be attributed to some inflation of prices but most of it was the result of the extension of mechanization, improved machinery and using machinery to replace labour.

This growth in machinery investment was paralleled in other technology. The use of commercial fertilizers increased threefold between 1941 and 1961 (from 324,000 tons to 1,077,000 tons). Herbicides and other pesticides used by farmers increased even more rapidly, by almost five times (Table 5-6).

TABLE 5-5

Value of Machinery and Equipment on Farms, Canada

Year	Value
	$ 000,000
1921	665.2
1931	650.7
1941	596.0
1951	1,933.3
1961	2,568.6
1966	3,552.4

Source: Census of Canada.

TABLE 5-6

Sales of Pesticides, Canada, 1947 and 1961

Year	Herbicides	Crop & Feed	Livestock	Total
	$ 000			
1947	1,046	3,936	449	5,432
1961	10,925	12,329	2,420	25,674

Source: Sales of Pest Control Products by Canadian Registrants. D.B.S.

The use of antibiotics, hormones, vitamins and balanced nutrition expanded rapidly, reducing the risk and multiplying the yields in livestock and poultry feeding. At the same time, new techniques for soil and water conservation and new varieties of field and horticultural crops brought increased and more certain crop yields.

Yet gains from this technical transformation were not evenly distributed. For example, the mechanization of crop production was most profitable where land areas were relatively large, level and free of stones. Much of the new technology

(pesticides, fertilizers, etc.), was economically justified only on better-quality soils where yields would be sufficiently increased to make it profitable. Thus, the technological improvements in agriculture, because they could be most profitably applied on the higher-quality soils and on the larger-scale farms, have notably increased the advantages of such farms over small farms with poor soils. The outcome has been that profitable crop production has been increased and intensified mainly on the better farmlands. At the same time, much of the poorer-quality, rougher lands have been virtually excluded from profitable crop production by the new conditions. A considerable proportion of these poorer farms are now in the process of abandonment, as far as cropping is concerned, in eastern and central Canada and the Prairie provinces. Many of these farms lie in the rough and less fertile lands along the fringe of the Canadian Shield, between the margin of arable farming on the one side and the forest margin on the other. The Atlantic provinces have much of this type of land in their Appalachian region. Farming on these lower-grade lands is passing through a difficult stage of land-use adjustment.

Transformation in Farm Organization and Productivity

In the postwar transition in Canada's agriculture the farm labour force has declined sharply. The number of farms has decreased. The average size of farms has increased. Mechanization and technology greatly increased the capital and financing requirements per farm, especially on that relatively small but productively important proportion of farms on which such new techniques were comprehensively applied. Yet the greater efficiency in the use of capital per acre as farms grew larger tended to hold down the total volume of capital in agriculture. From 1950 to 1960 the value of tangible farm capital increased only 54 per cent, mainly an increase in the value of land (Table 5-11).

Meanwhile, the productivity of farm labour in Canada was increasing rapidly. In the 20 years 1946 to 1966 the output per person employed in agriculture increased almost threefold (Table 5-7). Output per man-hour in agriculture increased more than threefold. This was a remarkable improvement in productivity, especially when compared with that of the non-agricultural industries where output per person rose only about 60 per cent from 1946 to 1966 and output per man-hour rose from an index of 96.2 to an index of 174.6 or only 81 per cent (Table 5-7). It is notable also that in recent years (1965 and 1966) the rate of increase in productivity per person was declining in the non-agricultural industries while in agriculture it was still increasing.1/ The higher rate of productivity increase in agriculture is attributable in part to the continuing departure of

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1/ Daily Bulletin, D.B.S. 36 (139): 2 *et seq*. July 20, 1967.

small-farm operators from farming in recent years, especially from those areas where physical or economic disadvantages make it unlikely that large-scale farm enterprises can be profitable.

More farm products were being produced by fewer people. While the farm labour force was reduced by half, the output of farm products rose by over 53 per cent from 1946 to 1966.[1/]

TABLE 5-7

Aggregate Productivity Trends, Canada, 1946-1966
(Indexes based on 1949=100)

Year	Agriculture			Commercial Non-Agricultural Industries		
	Persons Employed	Output Per Person Employed	Output Per Man-Hour	Persons Employed	Output Per Person Employed	Output Per Man-Hour
1946	109.4	100.0	97.6	86.9	98.1	96.2
1947	103.5	99.3	100.4	94.6	98.1	97.3
1948	101.1	104.9	105.3	97.8	98.5	97.7
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	93.9	113.1	115.7	102.0	104.6	106.7
1951	86.6	139.6	140.3	107.7	106.0	108.9
1952	82.2	181.0	180.2	110.4	108.3	112.2
1953	79.2	172.2	168.0	112.1	112.2	116.9
1954	81.0	128.8	124.4	110.6	113.9	120.1
1955	75.6	174.9	168.5	114.1	120.5	127.4
1956	71.6	198.0	189.4	121.0	124.7	131.2
1957	68.6	171.2	165.7	124.5	123.3	131.9
1958	65.7	190.5	187.5	121.3	127.1	137.2
1959	63.8	196.0	193.4	124.3	131.8	141.9
1960	62.3	205.5	203.5	124.2	133.8	145.0
1961	62.2	186.5	188.3	124.7	137.0	150.7
1962	60.2	223.6	227.2	128.4	141.0	154.1
1963	59.1	249.5	256.9	131.5	145.4	159.6
1964	57.6	243.6	254.7	137.4	149.8	164.2
1965	54.2	276.4	292.0	144.0	153.5	170.1
1966	49.6	337.5	350.6	151.0	156.3	174.6

Source: Daily Bulletin, D.B.S. 36 (139): 3-4. July 20, 1967.

1/ Same, p. 4.

Canada's farm labour force had held fairly stable at close to 1.2 million workers from 1931 to 1946, but from 1946 to 1961 it fell more than 43 per cent and dropped another 10 per cent by 1966 (Table 5-8). The major part of this reduction was in the labour force in Central Canada where new industrial employment opportunities had developed most rapidly. Between 1946 and 1966, the loss of farm workers in Ontario and Québec was 351,000, or 59 per cent. Of the total decline in Canada's farm labour force from 1946 to 1966, Ontario and Québec accounted for almost 55 per cent. The share of Canada's agricultural labour force in these two provinces decreased from 50 per cent in 1946 to 45 per cent in 1966.

The release of land represented by this migration from farms was substantial. It resulted in a reduction in the number of farms and an increase in the size of farms (Table 5-9). Consolidation of farms was particularly notable in the Prairies where the average increase in farm size was more than two-and-a-half times in the 25 years, 1941 to 1966. In the Central and Atlantic regions the number of farms declined sharply but the increase in the size of farms was not inversely proportional, indicating that more of the farm land was completely abandoned in Eastern Canada than in the Prairies.

Yet while in all regions the number of farms declined in the 25 years 1941-1966, and the average size of farm increased, there was a remarkable shift in the regional location of agriculture. This regional shift may be illustrated by the relative change in the share of farm acreage among regions (Table 5-10).

TABLE 5-8

Agricultural Labour Force by Regions, 1946-1961

Year	Atlantic	Québec	Ontario	Prairies	British Columbia	Total
	-----	-----	----- 000	-----	-----	-----
1946	92	277	320	466	31	1,186
1951	62	229	238	382	28	939
1956	49	165	213	323	26	776
1961	56	137	162	293	26	674
1966	32	106	140	240	25	544

Source: Census of Canada.

TABLE 5-9

Number of Farms, Total Farm Acreage, Average Farm Acreage, Canada and Regions, Selected Years

Year	Item	Canada*	Atlantic Region	Central Region	Prairie Region	British Columbia
1941	Number of farms	677,500	69,100	312,100	275,500	21,800
	Total acres (000)	173,563	8,950	40,451	120,130	4,034
	Av. size (acres)	256	130	130	436	185
1951	Number of farms	623,091	63,709	284,256	248,716	26,406
	Total acres (000)	174,047	7,824	37,666	123,863	4,702
	Av. size (acres)	279	123	132	498	178
1961	Number of farms	480,877‡	33,391	217,110	210,442	19,934
	Total acres (000)	172,542	5,390	32,777	129,814	4,507
	Av. size (acres)	358	161	150	616	226
1966	Number of farms	430,503	26,393	190,181	194,844	19,085
	Total acres (000)	174,121	4,591	30,712	133,476	5,292
	Av. size (acres)	404	173	161	685	277

* Excludes farms in the Yukon and Northwest Territories.

‡ The census definition of a farm changed in 1961 and the change among other things excluded all farms three acres and over in size from which less than $50 worth of farm products had been sold, a class of farms that had been included in the census previously. In short, it eliminated rural properties that were not engaged in farming for profit. In all, some 40,731 farms were eliminated from the 1961 Census that would have been counted had the 1951 and 1956 Census definition of farms been used. Of this 40,731 farms not included in 1961, 14,587 were in the Atlantic provinces and 12,291 were in Nova Scotia and New Brunswick.

Source: Census of Canada.

TABLE 5-10

Distribution of Land in Farms by Region, Canada, Census Years

Year	Canada	Atlantic	Central	Prairie	British Columbia
	%	%	%	%	%
1941	100.0	5.2	23.3	69.2	2.3
1951	100.0	4.5	21.6	71.2	2.7
1961	100.0	3.1	19.0	75.3	2.6
1966	100.0	2.6	17.6	76.7	3.0

Source: Census of Canada.

There was a major shift of farm acreage from the Atlantic and Central regions to the Prairie region, evidence of the growing economic advantages of large-scale machine cropping.1/ Only in British Columbia has the farm acreage increased as it has in the Prairies. Canada's total farm acreage has changed very little in the 25-year period. It was 173.6 million acres in 1941 and 174.1 million in 1966. But in the Atlantic provinces it has been cut in half. In Ontario and Québec it declined by 25 per cent. In the Prairies, it increased 11 per cent and in British Columbia it was 13 per cent higher.

By 1966, the Atlantic provinces' share of farm acreage had fallen behind British Columbia's. The Prairies' share in 1966 was 76.7 per cent and increasing. In 1966, for the first time, the Prairies had more farms (194,844) than any other region.

The shift away from rough, broken lands and toward large, level and fertile acreage was remarkable in so short a period. The evidence indicated that the adjustment was still far from being completed in 1966. Indications were that many older farmers were living out their last years on farms because it had become home to them but that many of these farms would not be operated after present incumbents gave up farming.

1/ The view that the federal feed-freight assistance was a major factor in this shift should not be taken too seriously. The forces behind these regional adjustments were at work before the feed-freight assistance was inaugurated. The freight assistance probably softened the impact of the adjustment for a time at least.

An important feature of these changes, and one not readily demonstrated by the statistics, was the increasing tendency for farms to be distinctly divided into two kinds. On the one hand, there were more of the larger-scale farms. These provided the bulk of farm production, comprising probably less than 30 per cent of the number of farms but producing 70 per cent or more of the farm output. On the other hand, a great many farms remained small, producing only a small part of the output but comprehending probably 70 per cent of the number of farmers. The disparity in incomes and opportunities tended to widen between these two broad types of farmers as technological improvement and farm consolidation advanced. In financing, the demand for credit from the larger-scale farmers tended to approach more closely the kind that commercial institutions might be expected to provide. But, for the small-farm group, the demand for credit made little progress toward meeting commercial supply conditions. It seemed increasingly evident that many small-scale farmers who had the capacity and desire to expand their operations might find the obstacles to expansion even greater than in the past.

The influence of these numerous small farms is evident in the growth and structure of farm capital in Canada. The recorded growth of total farm capital in Canada (Table 5-11) has been dominated by the capital on small farms on which the growth was primarily an increase in the valuation of the land rather than an increase in other capital resources. The rise in productivity of farming tended to be substantially less on these small farms than on the larger farms. But in the larger enterprises, while there was a sharp increase in capital per farm, there tended to be a decrease in the capital used per acre of land. The growth of total capital in Canada thus reflects only to a limited degree the sharp increase in capital per farm on the larger farms because the increase in land values of the many small farms comprised so much of the total increase. In 1966, for example, the value of tangible farm assets at \$19,165 million (Table 5-11) was equivalent to an average capital value per farm of just over \$44,500, an increase from just over \$15,000 in 1951. Yet a special survey of the medium-sized farms financed through the Farm Credit Corporation showed the average investment on such medium-sized farms was \$45,000 per farm in 1962. Even this survey failed to show how significant capital had become on the largest farm enterprises. There were now a substantial number of these, especially in the Prairies, for which the investment would be much larger than \$45,000. Records of farm management study groups in 1960-61 in Saskatchewan and Manitoba illustrated this (Table 5-12). A substantial number of the farms in these studies had capital investments of \$75,000 or more.

The increase in total capital on Canadian farms was substantial, rising from \$9.2 billion in 1950 to \$21.6 billion in 1966. Land and building investment increased from \$5.0 billion in 1950 to \$13.5 billion in 1966, mainly through higher

TABLE 5-11

Current Values of Farm Capital, Canada, 1950-1966

Year	Land and Buildings	Implements and Machines	Livestock and Poultry	Total Tangible Assets	Cash Operating Expenses	Total Farm Capital
	$ 000,000					
1950	5,023	1,681	1,468	8,171	1,096	9,284
1951	5,513	1,932	2,006	9,459	1,219	10,691
1952	5,668	2,077	1,791	9,536	1,277	10,771
1953	6,296	2,258	1,557	10,110	1,261	11,030
1954	6,183	2,353	1,424	9,960	1,251	10,942
1955	6,567	2,284	1,463	10,313	1,313	11,258
1956	6,853	2,263	1,423	10,539	1,426	11,548
1957	6,958	2,371	1,512	10,842	1,407	11,685
1958	7,441	2,441	1,860	11,742	1,504	12,439
1959	7,842	2,510	1,956	12,308	1,601	12,934
1960	8,227	2,575	1,878	12,680	1,666	13,188
1961	8,603	2,566	1,990	13,159	1,671	13,735
1962	8,974	2,656	2,054	13,684	1,776	15,460
1963	9,639	2,782	2,120	14,541	1,959	16,500
1964	10,676	2,948	2,166	15,790	2,067	17,857
1965	12,039	3,140	2,102	17,282	2,240	19,527
1966	13,467	3,386	2,312	19,165	2,424	21,589

Source: Quarterly Bulletin of Agricultural Statistics, D.B.S.; Handbook of Agricultural Statistics, Part II, Farm Income 1926-1965, D.B.S. June 1967.

TABLE 5-12

Average Capital Investment Per Study Farm

	Size	No. of Farms	Investment
	acres	no.	$
Saskatchewan	0 - 480	4	35,626
	481 - 800	16	42,252
	801 - 1,120	16	51,763
	1,121 - 1,440	9	75,000
	Over 1,440	5	116,776
Manitoba	Under 400	13	30,509
	400 - 599	21	41,027
	Over 599	26	75,932

Source: 1961 Saskatchewan Farm Business Summary; 1960 Annual Report, Carman District (Manitoba) Farm Business Association.

land prices. Machinery investment rose 100 per cent to $3.4 billion. Livestock and poultry rose 59 per cent to $2.3 billion. Operating capital rose 118 per cent to $2.4 billion (Table 5-12).

In summary, on the farms that were expanded, the capital per farm increased but the investment per acre or per unit of output tended to decrease. The great majority of farms remained small. Operations on these had not been significantly expanded and, while capital investment per farm increased to some extent, it rose mainly through higher values being placed on existing farm assets, particularly land. In this period also, there was a substantial abandonment of farms and these abandoned farms were commonly shifted into other, non-cropping, uses. Between abandonment and consolidation of farms, the number of farms in Canada declined by 192,000 from 1951 to 1966.

There was undoubtedly a substantial improvement in the effectiveness of the use of resources in farm production. Yet it was also clear that this improvement in resource use was mainly on the larger farm enterprises comprising about 30 per cent of the farms but producing about 70 per cent of the farm output. On the other 70 per cent of the farms, mainly small-scale farms, the effectiveness of resource use had not improved to the same extent. For these small farms, special measures, including special financing, appeared to be a necessary component for improving the productivity of farm resources.

6. IMPACT OF THE NEW ENVIRONMENT ON MARITIME AGRICULTURE

The postwar impact of the new technological environment was greatest in the regions having large areas of level and fertile land suitable for large-scale mechanized operations. In regions like the Maritime provinces, the impact on farming was held back by the physical, economic and institutional conditions that prevailed. When the impact came to the Maritimes, it came later. Its effects were different and they were more severe.

The features of the Maritime environment that prevented the adjustment to the new technology may be briefly reviewed. The physical environment presented three major obstacles - land, climate and location. The <u>land</u> being used for farming was frequently unsuitable for large-scale cropping enterprises because of rough topography, stones, bedrock, poorly drained areas, fences, roads, etc., which cut the land into areas too small, misshapen or rough for efficient machine operations. The soils were podzolized and were frequently too infertile to warrant improvement with lime and fertilizers. Moreover, it was difficult to consolidate existing farms into units large enough for effective farm enterprises. The <u>climate</u> was less favourable for profitable farming than in competing regions. The growing season tended to be relatively short and cool. Higher humidity, more frequent rain and less sunshine tended to increase costs of production, inhibit maturing of crops and increase the requirements for shelter for livestock. <u>Location</u> of farming areas at a distance from main market centres or main transportation arteries frequently added to the cost of transportation and made the organization of marketing services more difficult and costly.

There were also economic handicaps to adjustment in the Maritimes. These economic difficulties lay mainly in the low incomes and the lack of readily available and remunerative alternative employment. In consequence, excessive underemployment became common in agriculture, farm incomes remained low and farm people tended to remain on the land because they could not finance the move to more distant regions where employment was available. In these other regions, attractive alternative employment had been one of the most dynamic elements in supporting the shift out of low-income farming.

The institutional obstacles to adjustment lay partly in the pattern of land holdings and partly in the established traditions and habits of the people. The pattern of settlement and the division of farms as they passed from one generation to the next had resulted in many small holdings, each separately owned. Difficulties of consolidating small farms into larger units were not remedied. The lack of alternative employment had led to much underemployment on small farms and a tradition among farmers of using unemployed time for temporary leisure. Many

underemployed farmers have more recently been attracted by opportunities for remunerative employment in other regions.

These are some of the physical, economic and institutional features of the Maritime environment which have held back the adaptation of farming to the new technological opportunities in agriculture. The Maritime provinces are not much different in these environmental handicaps from other farming regions in Canada such as the Ottawa Valley in Ontario and the Interlake region in Manitoba. Yet in all of these regions the effect of the technological revolution will be substantial even though it may be delayed. It may require the shift of farming to a new generation, much of which will take place within the next decade, before the effects are fully apparent. The nature of the prospective changes have become evident in the trends of Maritime agriculture over the past decade or more. In appraising these trends in relation to farming in Canada as a whole, it should be noted that most farmers in Canada, especially those in Québec and Ontario, are living in areas which have similar adverse conditions relative to the new technology.

The failure of farming in the Maritime provinces to keep pace with agriculture in the rest of Canada in the past two decades may be indicated by measurement of the physical volume (weighted) of agricultural production (Table 6-1). Since 1949, the index shows that Canada's physical volume of agricultural production has risen steadily, and by 1965 had risen by 62 per cent (the 1966 index was distorted upward by the large Prairie wheat crop). Production in Prince Edward Island had changed very little in the decade 1957 to 1966. In Nova Scotia, there was some increase, but production had not, by the mid-1960's, regained the level it had reached in 1935-39, when it average 130.7. In New Brunswick, except for the variation of a few years, physical output seems to have changed very little over the period.

The value of agricultural production as a proportion of total production has declined relatively more in the Maritime provinces since 1950 than it has in Canada as a whole (Table 6-2). For Canada as a whole, agriculture dropped from 10.6 per cent of total production in 1950 to 6.1 per cent in 1962. In the Maritime provinces agriculture dropped from 8.7 per cent to 3.4 per cent in the same period.

The number of farms declined much more rapidly after 1941 in the Maritime provinces than in the rest of Canada, but the size of farms did not increase proportionately. For Canada, the number of farms declined by 206,000, or roughly 30 per cent, from 1941 to 1966 - 156,000 from 1941 to 1961 and 50,400 from 1961 to 1966 (Table 6-3).1/ For the Maritimes over the same period the decline in farms was 31,400, or over 45 per cent, with a decline in New Brunswick of 49 per cent, in Nova Scotia of 45 per cent and in Prince Edward Island of 38 per cent.

1/ This excludes any reduction due to the change in the census definition of a farm in 1961.

TABLE 6-1

Index Numbers of Physical Volume of Agricultural Production, Canada and Selected Provinces, 1946-1966
(1949=100)

Year	Canada	P.E.I.	N.S.	N.B.	Qué.	Ont.	Alta.
1946	107.6	75.9	122.7	91.6	95.4	95.8	127.3
1947	100.6	80.7	103.0	90.4	97.3	90.6	123.6
1948	104.9	83.8	103.7	94.1	102.3	95.7	121.8
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	110.4	91.6	103.4	95.6	108.0	99.3	115.5
1951	122.3	76.7	93.8	79.8	107.0	103.1	149.9
1952	140.0	96.6	106.1	85.9	113.6	105.5	167.2
1953	130.2	98.7	106.2	91.6	108.1	110.1	160.1
1954	104.0	96.1	115.9	84.5	109.5	105.6	122.3
1955	127.1	96.2	114.1	90.6	117.9	107.4	147.8
1956	136.5	94.7	112.6	91.8	116.9	108.8	163.5
1957	117.0	99.8	110.9	88.5	117.9	115.4	130.7
1958	128.2	98.7	109.4	85.7	123.8	128.0	150.4
1959	127.3	90.5	111.4	80.0	123.8	121.7	154.9
1960	133.7	89.2	112.3	84.7	124.1	122.8	146.3
1961	116.1	93.0	118.9	87.1	133.3	134.1	144.9
1962	147.6	94.0	124.2	89.3	142.4	139.5	157.4
1963	162.0	94.4	126.4	87.7	142.7	140.5	182.0
1964	150.9	103.9	125.1	92.1	143.2	146.8	174.7
1965	162.0	97.0	135.8	90.5	147.8	148.4	187.9
1966	182.8	105.9	131.9	98.4	154.2	156.0	215.3

Source: Quarterly Bulletin of Agricultural Statistics, April-June 1967, D.B.S.

TABLE 6-2

Net Value of Agricultural Production (NVAP)
As a Percentage of Gross Product
At Market Prices, Selected Years

	1951	1955	1960	1962
	%	%	%	%
Canada*	10.6	7.3	7.9	6.1
Maritime Provinces	8.7	5.5	4.7	3.4
Prince Edward Island	27.0	21.8	17.1	11.2
Nova Scotia	6.0	3.7	2.9	2.5
New Brunswick	9.7	5.5	5.2	3.4

* Excludes Newfoundland.
Source: Adapted from R.K. Fletcher, Postwar agricultural trends in the Atlantic Provinces, Atlantic Provinces Economic Council, 1966. Table 7, p. 28.

TABLE 6-3

Number of Farms, Canada and Selected Provinces, Census Years, 1941-1966

	1941*	1951*	1956*	1961*	1961‡	1966‡
	000					
Canada	677.5	623.1	575.0	521.6	480.9	430.5
Maritime Provinces	69.1	60.0	52.6	44.6	31.6	24.7
Prince Edward Island	11.4	10.1	9.4	8.0	7.3	6.4
Nova Scotia	27.9	23.5	21.1	18.3	12.5	9.6
New Brunswick	29.8	26.4	22.1	18.3	11.8	8.7

* Using 1951 Census definition of a farm, i.e., three acres or more in size or from one to three acres with agricultural production valued at $250 or more.

‡ Using 1961 Census definition of a farm, i.e., a holding of one acre or more with farm sales valued at $50 or more. It may be noted that the 1961 definition excluded non-farm holdings, i.e., those not selling any farm produce (of which there were 12,000 in Nova Scotia and New Brunswick in 1961) but included more of those that were selling produce.

Source: Census of Canada.

The average size of farm in the Maritime provinces has increased somewhat but relatively less than the increase in Canada as a whole (Table 6-4). Also, the Maritime increase in average size has not kept pace with the decline in numbers of farms. In the farming regions in Canada where the new technology was utilized most fully the size of farms was rapidly increased by the consolidation of holdings into larger units. In the Maritimes, the average farm size increased less relative to the decline in numbers than in Canada as a whole, indicating that more farms were abandoned altogether. Yet the most remarkable feature of the change in farm size was the small increase in acres of improved land per farm in the Maritime provinces (Tables 6-4 and 6-5).

In all Canada, almost two-thirds of the area in farms was improved land in 1966, but in Nova Scotia only about 26 per cent and in New Brunswick only 35 per cent of the land in the average farm had been improved. It is not surprising that average farm income was low in the Maritimes, when only 51 (Nova Scotia), 73 (New Brunswick) and 90 (Prince Edward Island) acres of the average farm had been improved, with the rest left largely

TABLE 6-4

Average Size of Farms, Total Acres, Census Years, 1941-1966

Year	Canada	Prince Edward Island	Nova Scotia	New Brunswick	Ontario
	-------------	-------------	acres	-------------	-------------
1941	237	96	116	124	126
1951	279	108	135	131	139
1956	302	113	132	135	141
1961	359	131	178	187	153
1966	404	146	192	208	162

Source: Census of Canada.

TABLE 6-5

Average Size of Farms, Improved Acres, Census Years, 1941-1966

Year	Canada	Prince Edward Island	Nova Scotia	New Brunswick	Ontario
	-------------	-------------	acres	-------------	-------------
1941	125	60	25	39	75
1951	155	64	28	38	85
1956	174	68	30	43	89
1961	236	79	40	62	99
1966	251	90	51	73	109

Source: Census of Canada.

in its natural state. It is a measure of the quality of the land and the relatively high cost of its improvement that so little of the land in farms had been improved.

Some of the small units of improved land could be combined, by consolidation of farms, into larger units, and thus made into more effective farm enterprises. Yet many of these small farms are very small, and many are either single isolated units or are comprised in such small total areas that little could be done to improve their economic position. An attempt was made in this project to identify these areas in the Maritimes where there is enough suitable farm land in a block for a

group of farms on an appropriately large scale of operations, but adequate information was not yet available for such a compilation to be included in this study. When these areas can be properly identified, by photo analyses and soil surveys, more progress in profitable farming can be anticipated. Until this is accomplished it may be expected that crop farming will continue to be quite uncertain.

A critical feature in the structure of farming is found also in the very small contribution made by so many of the farms to the output of farm products. In Nova Scotia, for example, 70 per cent of the farms were so small they accounted for only 15 per cent of the sales of farm products (Table 6-6). In New Brunswick 74 per cent of the farms accounted for 18 per cent of farm sales. In the main, it is these small farms with small incomes that are going out of production or being abandoned. It may be evident that farm output will not be greatly affected if most of them cease farming. It is likely that many will discontinue operations in the next decade.[1/]

Along with these basic trends in Maritime farming are a number of other trends that will be examined in later sections of this report. The farm labour force has declined by two-thirds in the Maritimes compared with less than half for Canada as a whole. The younger farm people are not taking over farming operations from their parents in the Maritimes (especially in Nova Scotia and New Brunswick) as much as in Canada as a whole. The average age of farmers in the Maritimes tends to be substantially higher than in the rest of Canada. There are clear indications that when many of the present older farmers in the Maritimes retire they will have no one to take over the enterprise from them.

A notable feature of these downward trends in Maritime farming is that so much of the decline has taken place in the decade 1956-66, and a great deal from 1961 to 1966. The extremely sharp declines in numbers and area of farms in Nova Scotia and New Brunswick are particularly remarkable in this respect.

These data indicate that the impact of the new technology on Maritime farming may be only now getting well under way and that in the next decade the effects may be even more severe. For this reason, as far as agricultural policy is concerned, it may be more rational to plan for the situation that is likely to exist by 1975 or 1980 than to base policy on the current position and trends. There may be a tendency to underestimate the extent of the decline in Maritime farming that is likely to occur. It may be expected that a great many more Maritime farms will be abandoned within the next decade and that

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1/ Only 1,000 farms, of the size of the largest 250 farms in Nova Scotia, would have been needed in 1966 to provide the total volume of sales from all 9,621 farms recorded in that year in the census.

TABLE 6-6

Estimated Contribution to Farm Sales
Made by Smallest Farms, 1966

Province	Per Cent of Farms	Per Cent of Farm Sales
	%	%
Nova Scotia	70	15
New Brunswick	74	18
Prince Edward Island	70	25
Ontario	65	21
Canada	69	28

Source: Census of Canada, 1966.

most of those that remain will still be small enterprises marked by increasing poverty. In this context, current trends seem to indicate that the future decline in farming in Prince Edward Island will not be as great as in the other two provinces. Whether or not events bear this out, several considerations should be taken into account in the Island's current adjustment. One consideration is that farm land is quite limited in Prince Edward Island (only 927,000 acres were farmed in 1966). A second consideration is that Prince Edward Island farming is still quite isolated and - although incomes are low - alternative employment remains scarce. A third consideration is the uncertainties and delays in transportation to the mainland. These considerations have undoubtedly delayed the adjustment and movement out of farming in Prince Edward Island. If they delay it much longer, without improvement of incomes, other land uses like summer homes, forestry, recreation, "gentlemen's farms" etc., will undoubtedly soon take much of the land out of commercial farming because of its low price.

It is evident that in the Maritimes the adoption of the new technology and the adjustments this implied have been substantially delayed. These delays in adjustment have permitted other disadvantages to accumulate. As the technological revolution advanced in more favoured regions, it tended to undermine the competitive capacity of established Maritime agriculture. The most serious evidence of these disadvantages is that the income position of Maritime farmers has deteriorated even though their farming operations remained relatively unchanged. This deterioration is related to the more rapid improvement in other regions.

Because in other regions large-scale enterprises have been developed which can most effectively use the new technology, their output per unit of input has increased remarkably, and costs per unit have accordingly been lowered. As a result of these lower costs in other regions, farm product prices have not risen as much as prices of other things. The large-scale operator elsewhere has been able to make a good profit with prices little, if any, higher because of his lower costs per unit of output. What this means for the small-scale farmer who has had little benefit from higher productivity is that he has had a substantial increase in his costs (i.e., prices of supplies) but little increase in his selling prices. Instead of his unit costs going down, like those of the large-scale farmer, they have been going up. Instead of his net farm income staying the same because his operations are the same, it has been going down.

It is this impact of the new technology that is now impinging on Maritime agriculture. It may be expected that this impact will be much more severe and more likely to stimulate changes from now on than the earlier impact of technology was able to do. This explains why Maritime agriculture, which proved largely resistant to the initial stages of the technological revolution, was beginning to weaken rapidly in the late 1960's under this doubling of its current impact. It explains why the number of farms and the people on farms have declined so rapidly from 1961 to 1966. It indicates that careful consideration must be given to the future development of agriculture if it is to be stabilized against the pressures now impinging on it.

This is the objective of the enterprise analysis presented later: to appraise for the Maritime region, and for each of the provinces, the relative level of comparative advantage of their major farm enterprises. To appraise such enterprises satisfactorily, it would be necessary to have a great deal more information, especially on the comparative productivity of the various qualities of land in each region in terms of grains, forages, hay, silage, etc., than was now available. Yet even with this lack of full productivity information, it has been possible to make some very excellent comparisons of competitive enterprises.

7. POPULATION AND LABOUR FORCE

Population fills two roles in the economy - it provides the labour force required to produce the goods and services and it provides the families required to consume them. These two roles of population are closely linked together by the level of employment, output and incomes that the population enjoys. When employment and incomes are high, the consumer population is able to spend more for things beyond the basic necessities of life. But when employment and incomes are low, consumers must spend a larger share of their income on the necessities (food, shelter and clothing)1/ and at such times they usually try to provide more of their own subsistance (garden produce, fuel, and other income-in-kind). These considerations need to be emphasized in appraising the Maritime agricultural industry because they are critical for its future progress.

Because the population of the Maritime provinces has continued for several decades to be more rural than the rest of Canada (Table 7-1), it has also normally been more self-sufficient in providing its own food and other requirements than the populations of other provinces. This is partly illustrated by the higher proportion of income-in-kind in net farm income (Table 7-2). The lack of attractive alternative employment opportunities in the Maritimes has tended to maintain this higher proportion of rural population. The demand for food products has accordingly not risen as rapidly in the Maritimes as it has in other regions where the increase in urban population (city-dwellers buy more of their food) has been much greater than the increase in rural population in the past two decades (Table 7-1).

There has also been more unemployment (Table 7-3)2/ and lower incomes (Table 7-4) in the Maritimes than in Canada as a whole. These have weakened the demand for farm products and have tended to stimulate outmigration of people. As a result, population and consumer demand have grown much more slowly than in the rest of Canada.

1/ Compare Ernst Engel's law of consumption, "The poorer a family, the greater the proportion of the total outgo that must be used for food".

2/ Unfortunately unemployment data are available only for the Atlantic region as a whole, which includes Newfoundland with the Maritime provinces. However, there is little indication that the pattern would be changed by excluding Newfoundland.

TABLE 7-1

Total, Rural and Farm Population, Canada and Maritime Provinces, Selected Years

Provinces and Years	Total Population	Rural Population (farm and non-farm)		Farm Population	
	no.	no.	%	no.	%
Canada					
1951	14,009,429	5,381,176	38.4	2,827,732	20.2
1961	18,238,247	5,537,857	30.4	2,072,785	11.4
1966	20,014,880	5,288,121	26.4	1,913,714	9.6
Prince Edward Island					
1951	98,429	73,744	74.9	46,757	47.5
1961	104,629	70,720	67.6	34,514	33.0
1966	108,535	68,788	63.4	30,841	28.4
Nova Scotia					
1951	642,584	297,753	46.3	112,135	17.5
1961	737,007	336,495	45.7	56,832	7.7
1966	756,039	317,132	41.9	45,251	6.0
New Brunswick					
1951	515,697	300,686	58.3	145,771	28.3
1961	597,936	319,923	53.5	62,265	10.4
1966	616,788	304,563	49.4	51,504	8.4
Maritimes					
1951	1,256,710	672,183	53.5	304,663	24.2
1961	1,439,572	727,138	50.5	153,611	10.7
1966	1,481,362	690,483	46.6	127,596	8.6

Source: Census of Canada.

TABLE 7-2

Income-in-Kind as Percentage of Total Net Farm Income of Farm Operators, Canada and Maritime Provinces Five-Year Averages, 1946 to 1965

Years	Canada	Prince Edward Island	Nova Scotia	New Brunswick
	%	%	%	%
1941-45	27.3	41.7	59.6	49.0
1946-50	23.2	38.8	54.3	46.8
1951-55	21.8	32.3	43.7	49.4
1956-60	29.0	42.3	46.8	54.5
1961-65	27.8	47.9	45.4	54.9

Source: Handbook of Agricultural Statistics, Part II, Farm Income 1926-1965, June 1967. D.B.S.

TABLE 7-3

Percentage of Labour Force Unemployed, Canada and Regions, 1961-66

Region	1961	1962	1963	1964	1965	1966*
	%	%	%	%	%	%
Atlantic	11.2	10.7	9.5	7.8	7.4	6.4
Québec	9.2	7.5	7.5	6.4	5.4	4.8
Ontario	5.5	4.3	3.8	3.2	2.5	2.5
Prairies	4.6	3.9	3.7	3.1	2.6	2.1
British Columbia	8.5	6.6	6.4	5.3	4.1	4.4
Canada	7.1	5.9	5.5	4.7	3.9	3.6

* Average for first eight months.

Source: Adapted from Economic Council of Canada, Prices, productivity and employment. Third Annual Review, 1966. Table 7-3, p. 247. Unemployment data by provinces are not available.

TABLE 7-4

Personal Income Per Capita,
Canada and Maritime Provinces
(Constant 1949 dollars)

Annual Average*	Canada	Prince Edward Island	Nova Scotia	New Brunswick
	$	$	$	$
1939-41	662	330	479	423
1944-46	1,008	572	800	701
1949-51	962	538	700	651
1954-56	1,090	612	809	714
1959-61	1,198	752	912	800
1964-66	1,420	967	1,096	1,002

* Average of the three years shown. Incomes have been deflated by the Consumer Price Index (1949=100) pertinent to each province and to Canada.

Source: National Accounts, Income and Expenditure, and Canadian Statistical Review. D.B.S.

This slower growth in population is expected to continue. A study of population trends sponsored by the Atlantic Provinces Economic Council (Walton and McDonald, 1966) shows the Maritime population is expected to increase by only 0.7 per cent per year from 1964 to 1971,1/ while for Canada as a whole the expected population increase has been estimated at 1.8 per cent a year for the same period (Illing, 1967). This small rate of growth reflects to a degree the prospective migration of the younger adults from the region to seek employment and higher incomes elsewhere. Consumer demand arising from new family formation and home building is likely to be reduced as a result. The key to the problem lies in measures to expand incomes of the adult population which would, in turn, not only expand individual consumer demand but also tend to reduce emigration and increase immigration, thus increasing the total population and number of consumers. Overall, population growth as projected is not expected to be very significant as a stimulus to food consumption and to agricultural production. But there are indications that the population shift from rural areas to urban centres in the Maritime provinces may continue and that the rate of this shift will increase; these are likely to expand the farm market to a limited degree.

1/ The census of 1966, however, indicated that this estimated rate of increase was high (*see* Table 9-1).

The level of income of the population is also important in the demand for food products. Income per capita is lower in the Maritimes than in Canada as a whole (Table 7-4) for several reasons - the value of output per worker tends to be lower (partly due to lower productivity, as in agriculture), the proportion of the population participating in the labour force (both male and female) tends to be lower (Table 7-5),1/ the level of education tends to be below that of most other regions in Canada (Table 7-6), the proportion of those in the labour force that are fully or partly employed tends to be low (i.e., high unemployment), many of those included as employed are not fully employed (especially the underemployed farm workers) and there is a higher proportion of non-producers (children and old people) in the population than in Canada as a whole (Table 7-7). Altogether, these factors weaken the income-generating potential of the Maritimes and thus reduce the rate of growth in the demand for farm-produced food products.

TABLE 7-5

Civilian Labour Force Participation Rates, by Sex, 1961-64 Averages

	Canada	Atlantic Region	Ontario
	%	%	%
Male	78.9	71.8	81.3
Female	29.5	23.6	32.6
Total	54.0	47.4	56.6

Source: Civilian labour force as per cent of civilian population 14 years of age and over. Based on D.B.S. Labour Force Survey as compiled in Frank T. Denton, An analysis of interregional differences in manpower utilization and earnings. Staff Study No. 15, Economic Council of Canada, April 1966. p. 5.

1/ See also Walton and McDonald (1966), Table 29, p. 40.

TABLE 7-6

Percentage of Male Population in Selected Educational Categories, June 1, 1961

	Per Cent Who Did Not Go Beyond Elementary School	Per Cent With University Degrees
	%	%
Canada	52.4	4.0
Atlantic Region	59.0	2.3
Québec	59.5	4.0
Ontario	48.9	4.7
Prairie Region	50.7	3.4
British Columbia	40.2	4.3

Source: Adapted from Frank T. Denton, An analysis of interregional differences in manpower utilization and earnings. Staff Study No. 15, Economic Council of Canada, April 1966, p. 12. Persons still attending school and children under five years of age are excluded.

TABLE 7-7

Age Distribution of the Population, June 1, 1961

Age Group	Canada	Atlantic Region	Québec	Ontario	Prairie Region	British Columbia
	%	%	%	%	%	%
Under 15	33.9	37.6	35.4	32.2	34.1	31.3
15 to 64	58.5	54.6	58.8	59.7	57.7	58.5
65 and over	7.6	7.8	5.8	8.1	8.2	10.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Census of Canada, 1961.

Most of these deficiencies can be remedied over time by an expansion of attractive alternative employment opportunities either within or outside the Maritimes. But the latter alternative has not been politically acceptable until recent years. At the same time, the economic forces for mobility and change may be expected to strengthen as the income gap continues between farm employment in the Maritimes and alternative employment elsewhere. It may also be expected that the economic forces will become the dominant influence in the long run. An indication of this tendency is found in the evidence of the greater reduction of farm employment in the Atlantic region than in others even though farm incomes (though still very low) have been increasing at a much faster rate than in the rest of Canada (Table 7-8).

TABLE 7-8

Percentage Change in Income and Employment In Agricultural and Non-Agricultural Sectors, Canada and Regions, 1961 to 1965

Region or Province	Agriculture			Non-Agriculture		
	Income*	Employment	Income Per Worker	Income*	Employment	Income Per Worker
	%	%	%	%	%	%
Atlantic	8.3	-9.6	20.0	7.3	4.1	3.1
Québec	-1.5	-3.7	2.2	8.2	4.0	4.0
Ontario	3.1	-2.3	5.5	7.8	3.2	4.4
Prairies	13.0	-2.0	15.4	6.3	3.5	2.7
British Columbia	2.0	-5.9	8.1	8.7	5.2	3.7
Canada	6.6	-3.1	10.1	7.7	3.8	3.8

* Based on current dollars.

Source: Adapted from Economic Council of Canada, Prices, productivity and employment. Third Annual Review, 1966. Table 7-5, p. 252. 1961 is the average of 1960, 1961 and 1962.

The Labour Force

The prospective effectiveness of the population in its producing capacity as a labour force is also indicated by some of these characteristics. The productive capacity of the population is reduced by the lower participation rate. The participation rate for both men (71.8) and women (23.6) is substantially lower in the Atlantic region than that for any other region in Canada. The rate of unemployment in the Maritimes is substantially higher than in other regions in Canada. A third characteristic of the Maritime labour force is its lower level of educational attainment. A fourth characteristic is the age distribution of the population which shows a larger proportion of young (under 15 years) and old (65 and over) people and a smaller proportion in the working ages. This distribution reflects the outmigration of the younger adults.

In the main, these characteristics of the population and labour force are reflected in the agricultural labour force also, although the educational level attained by Maritime farmers, though low, is slightly higher than the level for farmers in Canada as a whole.

The farm labour force has declined very sharply in the Maritime provinces over the period 1941 to 1961. While the farm labour force for Canada fell by almost 40 per cent in that period, in the three Maritime provinces it fell by over 64 per cent (Table 7-9). In Nova Scotia and New Brunswick the drop was 68 per cent. A further substantial decline occurred in these three provinces from 1961 to 1966.

TABLE 7-9

Agricultural Labour Force, Canada and Maritime Provinces, Selected Years

Year	Canada	Prince Edward Island	Nova Scotia	New Brunswick	Maritime Provinces
			000		
1941	1,075	17	37	41	95
1951	826	13	24	27	64
1961	649	9	12	13	34

Source: Census of Canada.

The farm labour force represents a smaller proportion of the total labour force in the Maritime provinces (6 per cent in 1961) than in Canada (10 per cent). It is expected that the farm labour force in the Maritimes will continue to decline at a faster rate than in the rest of Canada. One indication of this is found in the age distribution of farm operators (Table 7-10). A substantially higher proportion of farm operators in the Maritimes were 60 years old or over in 1966 than in the rest of Canada; in Nova Scotia and New Brunswick the proportion had increased since 1961. A much smaller portion in the Maritimes were under 35 years. With more old, and fewer young farmers, it may be expected that by (say) 1975 many of the farmers who were 60 years or over in 1967 will have had to retire without having anyone to continue the operation of their farms. It will be in this period that the numbers of farms and of farmers will decline quite rapidly.

TABLE 7-10

Percentage Distribution of Farm Operators By Age, 1941-1966

Age	Canada	Prince Edward Island	Nova Scotia	New Brunswick
	%	%	%	%
Under 35				
1941	19.9	15.3	12.3	16.8
1951	21.7	16.6	13.1	16.6
1961	16.8	14.1	8.7	10.0
1966	15.2	14.5	8.6	9.3
35 to 59				
1941	57.8	54.2	51.3	55.1
1951	58.7	57.8	55.9	58.0
1961	62.7	57.6	59.4	62.1
1966	63.6	58.8	58.3	62.2
60 years & over				
1941	22.4	30.6	36.2	28.1
1951	19.6	25.6	31.0	25.4
1961	20.5	28.3	31.9	27.9
1966	21.2	26.7	33.1	28.5

Source: Canada Year Books; Census of Canada, 1966.

It is appropriate at this point to note that, while there is a large proportion of small-scale farmers who cannot be expected to take up large-scale farming, the farmers interviewed in the Maritimes in this survey were found to be able and skilful and fully capable of managing a modern farm enterprise. Many were remarkably intelligent and successful. We found no evidence in this group to support the suggestion, sometimes encountered, that farm enterprises in the Maritimes are less profitable than elsewhere because Maritime farmers lack knowledge, effort or ability.

It is expected that the farm labour force will decline quite rapidly in the Maritimes over the next decade. From 1961 to 1966, it may be estimated to have fallen from 34,000 to about 24,000.1/ By 1975, it is expected to decline by at least another 5,000 to 6,000 workers. This indicates the extent of the current surplus of farm labour now found in the Maritimes - a surplus which will be eliminated only by workers moving elsewhere for employment or by farm incomes rising to a high enough level to encourage young people to remain on the farms.

1/ Data on the farm labour force were not gathered in the Census of 1966.

8. CAPITAL AND FINANCING

The pattern of agricultural financing has been greatly altered by the technological revolution, particularly in those farming regions where large-scale enterprises are most prevalent. The most striking change is the great increase in the total capital required for each enterprise. (See Carr, 1962.) This increase in capital was not distributed equally for each type of enterprise. For cropping enterprises, there was usually a major increase in the capital invested in land, an increase in machinery capital per farm but a reduction of machinery capital per acre. For enterprises requiring little land, like poultry and hog enterprises, the investment in buildings, machinery and operating capital increased greatly. By 1967 capital investments in agricultural enterprises of $100,000 to $200,000 were not out of the ordinary. In many cases the major part of such an investment had been put together in the lifetime of the present farmer. The financing of such enterprises had required substantial changes in traditional credit and debt patterns, with the size of farm loans greatly increased and a greater frequency of additions to mortgage debt. The new technology was moving forward so rapidly that it had become necessary for farmers to invest much more frequently in new equipment or in expanded operations as a means of using the most efficient techniques to keep abreast of competitors. The increase in cash requirements for operating expenses was also remarkable. It was related to the shift from horse and oxen power to motor power and to the great increases in cash purchases from the rest of the economy, including fuels, feeds, fertilizers, pesticides.

These changes in the financial structure of farming had brought some changes in the pattern of credit. Yet as Canada approached the years when a new generation was about to take over farming1/ it was evident that some major new changes might be needed to meet future requirements. One was to make provision for financing the transfer of these high-capital enterprises from one generation to the next.2/ Another was to provide more adequately for credit for operating capital.

1/ There was a major changeover of farming to a new generation immediately after the war of 1939-1945. In consequence, a new generation will be taking over again in the decade centred on 1970-75.

2/ These transfers may frequently be financially disappointing because of a simple rule of economics that has governed the capital expansion of many farm enterprises. This rule is that the addition of more capital may be proportionally more profitable than the whole enterprise is, thus, the marginal returns of adding more land or more milking cows may be much greater than the average returns for the whole enterprise. This results in the market price for land or milk cows being bid higher than warranted by the average returns from them. As a result, when these farms are sold, the buyer needs to have a discount from the market price, in order to make a reasonable return.

In the Maritime provinces the pattern of financing has changed substantially, although not as much as in other major farming regions. The general increase in reported capital values of farm enterprises has resulted in considerable measure from the inflation of prices, particularly land prices. Thus, although the area of land in farms had decreased in all three Maritime provinces from 1950 to 1966 the total value of land increased (Tables 8-1, 8-2 and 8-3). The total tangible assets increased from 1950 to 1966 by 56 per cent in Prince Edward Island, by 18 per cent in Nova Scotia, and by 10 per cent in New Brunswick. In the same period the increase in tangible farm asset values for Canada as a whole was 134 per cent. Increases in cash operating expenses from 1950 to 1966 were substantial, arising partly from inflation of prices but mainly from changes in technology. Cash operating expenses from 1950 to 1966 in Prince Edward Island increased 115 per cent; in Nova Scotia, 89 per cent; in New Brunswick, 75 per cent; and in Canada, 121 per cent.

Capital investment per farm has increased substantially in the Maritimes, but again much of the increase is the result of price inflation. From 1951 to 1966, total capital per farm increased in Prince Edward Island from $9,812 to $22,624; in Nova Scotia, it increased from $7,489 to $21,453; and in New Brunswick from $6,465 to $23,214 (Table 8-4). For the Maritimes as a whole the increase was from an average of $7,430 in 1951 to $22,376 in 1966. In the same period, for Canada as a whole the increase was from $17,158 to $50,146. A substantial part of these increases were, of course, due to the inflation of prices over the period.

It would be desirable to make these comparisons on a constant-dollar basis to eliminate the effect of inflation, but this has not yet been found possible because of the difficulty of establishing suitable price indexes for deflating the capital value series. Price inflation of farm capital values in the Maritimes, especially of farm land values, has been markedly different from that of Canada as a whole and thus general price indexes applicable to the whole of Canada are not appropriate for deflating Maritime farm values.1/

1/ This is perhaps the major weakness of the deflation of Maritime farm capital attempted by Fletcher (1966) Table 18, where the Implicit Price Index of Business Gross Fixed Capital Formation was used as a deflator. This business capital index is not suitable for the deflation of the capital value of either farm land or livestock. It might be reasonably satisfactory for farm machinery values.

TABLE 8-1

Current Values of Farm Capital,
Prince Edward Island, 1950-1966

Year	Land and Buildings	Implements and Machines	Livestock and Poultry	Total Tangible Assets	Cash Operating Expenses	Total Farm Capital
			$ 000			
1950	44,550	14,653	16,660	75,863	11,866	87,729
1951	47,844	16,261	23,093	87,198	12,267	99,465
1952	48,519	17,841	19,287	85,647	14,482	100,129
1953	48,519	20,123	16,343	84,985	14,253	99,238
1954	47,168	21,400	15,540	84,108	14,192	98,300
1955	47,168	21,215	15,614	83,997	15,416	99,413
1956	48,519	22,022	14,638	85,179	15,448	100,627
1957	48,519	24,010	14,377	86,906	15,246	102,152
1958	50,508	25,115	16,149	91,772	16,233	108,005
1959	52,501	26,108	17,185	95,794	16,985	112,779
1960	52,501	26,774	16,754	96,029	18,045	114,074
1961	52,501	26,856	16,957	96,314	18,450	114,764
1962	54,852	28,099	16,969	99,920	18,110	118,030
1963	55,636	29,112	17,345	102,093	19,127	121,220
1964	57,203	30,116	17,740	105,059	20,179	125,238
1965	58,770	31,505	18,489	108,764	22,127	130,891
1966	65,039	33,959	19,317	118,315	25,506	143,821

Source: Quarterly Bulletin of Agricultural Statistics, and Handbook of Agricultural Statistics, Part II, Farm Income 1926-1965, June 1967. D.B.S.

TABLE 8-2

Current Values of Farm Capital, Nova Scotia, 1950-1966

Year	Land and Buildings	Implements and Machines	Livestock and Poultry	Total Tangible Assets	Cash Operating Expenses	Total Farm Capital
	$ 000					
1950	90,551	23,005	28,278	141,834	20,553	162,387
1951	94,486	25,224	32,955	152,665	23,444	176,109
1952	94,250	27,140	33,849	155,239	24,100	179,339
1953	94,250	29,575	28,425	152,250	23,656	175,906
1954	94,250	30,939	25,252	150,441	24,330	174,771
1955	94,198	30,020	25,958	150,176	24,676	174,852
1956	93,321	30,692	23,831	147,844	26,591	174,435
1957	93,321	32,369	22,352	148,032	25,425	173,457
1958	91,869	32,138	23,582	147,589	26,705	174,294
1959	90,125	32,115	26,703	148,943	27,982	176,925
1960	90,125	31,521	26,318	147,964	29,496	177,460
1961	89,263	30,252	26,642	146,157	29,968	176,125
1962	86,817	31,852	26,982	145,651	30,995	176,646
1963	86,817	32,777	26,828	146,422	32,593	179,015
1964	90,485	33,936	26,428	150,849	33,961	184,810
1965	94,153	35,498	26,317	155,968	35,349	191,317
1966	102,712	37,416	27,347	167,475	38,927	206,402

Source: Quarterly Bulletin of Agricultural Statistics, and Handbook of Agricultural Statistics, Part II, Farm Income 1926-1965, June 1967. D.B.S.

TABLE 8-3

Current Values of Farm Capital, New Brunswick, 1950-1966

Year	Land and Buildings	Implements and Machines	Livestock and Poultry	Total Tangible Assets	Cash Operating Expenses	Total Farm Capital
	$ 000					
1950	97,910	24,475	26,509	148,894	21,970	170,864
1951	98,717	26,971	32,120	157,808	24,794	182,602
1952	98,500	28,959	29,392	156,851	26,338	183,189
1953	97,504	31,448	26,785	155,737	25,795	181,532
1954	94,250	30,939	25,252	150,441	25,550	175,991
1955	97,504	31,669	23,814	152,987	26,220	179,207
1956	96,257	32,099	23,230	151,586	27,944	179,530
1957	95,646	33,732	21,787	151,165	26,814	177,979
1958	93,788	33,926	24,834	152,548	28,241	180,789
1959	91,930	33,943	25,001	150,874	29,745	180,619
1960	91,500	33,321	23,675	148,496	31,297	179,793
1961	90,115	31,682	23,617	145,414	31,780	177,194
1962	86,019	32,860	22,551	141,430	30,995	172,425
1963	84,654	34,007	22,297	140,958	32,563	173,521
1964	88,750	35,215	22,321	146,286	34,184	180,470
1965	92,846	36,870	21,752	151,468	35,604	187,072
1966	102,404	39,220	21,740	163,364	38,737	202,101

Source: Quarterly Bulletin of Agricultural Statistics, and Handbook of Agricultural Statistics, Part II, Farm Income 1926-1965, June 1967. D.B.S.

TABLE 8-4

Total Capital Value and Average Capital Value Per Farm, Canada and Selected Provinces, 1951 and 1966

Provinces and Years	Total Capital: Tangible Assets	Total Capital: Total Farm Capital	Number of Farms	Average Tangible Assets Per Farm	Average Total Farm Capital Per Farm
	$ 000	$ 000	no.	$	$
P.E.I.					
1951	87,198	99,465	10,137	8,602	9,812
1966	118,315	143,821	6,357	18,612	22,624
N.S.					
1951	152,665	176,109	23,515	6,492	7,489
1966	167,475	206,402	9,621	17,407	21,453
N.B.					
1951	148,894	170,864	26,431	5,633	6,465
1966	163,364	202,101	8,706	18,765	23,214
Maritimes					
1951	388,757	446,438	60,083	6,470	7,430
1966	449,154	552,324	24,684	18,196	22,376
Canada					
1951	9,459,000	10,691,000	623,091	15,181	17,158
1966	19,165,000	21,589,000	430,522	44,516	50,146

Source: Quarterly Bulletin of Agricultural Statistics, and Handbook of Agricultural Statistics, Part II, Farm Income 1926-1965, and Census of Canada, Agriculture, D.B.S.

Nevertheless, it may be concluded that, taking into account inflation of prices, elimination of many farms with their buildings, livestock, etc., from farming in the past decade or two, and changes in the capital structure of the remaining farms, total farm capital has declined in all Maritime provinces. Average capital per farm has increased over the past 15 years but, on most farms, capital investment was still too low in 1967 to permit farm operators to produce profitably enough to enjoy satisfactory incomes.

Financing and Credit

In the Maritimes, in the past, the financing of farming has been treated as a fairly simple and restricted activity. Farms, being generally small and having only a limited quantity of farm equipment, usually had a small total investment. With farm capital so small, the traditional "agricultural ladder" was the method used for acquiring farm ownership. In other words, the potential farmer would begin climbing toward the ownership of a farm by working either as a hired man or as the son of a farmer and would work until he had acquired a sufficient equity to enable him to take over the farm. He would then spend most of the rest of his life paying off the remaining mortgage.

Farming today, on a competitive large-scale specialized enterprise, requires very large amounts of capital, more than would enable a satisfactory equity to be earned in a few years as a hired hand, more than could be readily paid off in one lifetime. Moreover, the rapid rate of change of new technology requires that frequent borrowings of capital are necessary to keep the farm enterprise competitive. In addition, the amount of cash required for short-term operating capital has increased remarkably.

Our research has indicated that for many farm enterprises in the Maritimes to become as fully competitive as they can requires major inputs of additional capital in terms of land (in some cases), machinery and equipment, perhaps livestock, as well as much larger reserves of working capital for the purchase of fertilizers, pesticides, feeds or other materials and supplies.

Yet it may be necessary to change or modify the long-established procedures and criteria used for extending farm credit to meet these new requirements for capital expansion and adjustment. Most farms in the Maritimes are now too small in scale to be expanded into sound economic units with the size of loan that their net income would support in terms of ability to repay. It may be necessary to select operators to whom larger-than-ordinary loans can be made and to carry these loans for a few years without repayments as a means of getting these small enterprises expanded to a satisfactory basis initially. Good success has usually resulted when such selected borrowers also receive adequate supervision of the loan.

At the same time, it is likely to be found that the adaptation of farms to the new technology may be accomplished more readily by financing a whole new enterprise of the most suitable scale and specialization than by expansion and adaptation of existing small enterprises.

The description of the credit services available to Maritime farmers has already been well presented in other pub-

lications and need not be repeated here.[1/] In the main, both federal and provincial mortgage credit services have been reasonably satisfactory and could be, or are being, adapted to the particular needs of Maritime agriculture. The most serious weaknesses in mortgage credit relate to the size of the loans and the availability of proper supervision. The problem is that the loans that need to be made are larger than the usual small enterprise can afford to repay from the beginning. More supervision of such loans would enable larger loans to be made with a minimum of risk on the small farms, provided management was found adequate.

The greatest gap in farm credit in the Maritimes is in credit for short-term operating capital. In the main, it has been left to the banks and farm supply houses to provide this credit for operating expenses. But the banks tend to avoid such lending unless the farmer has an established record of adequate income and prompt repayment. Because of this limitation, banks ordinarily exclude farmer-borrowers who require development financing to initiate their enterprise expansion.[2/] On the other hand, banks are major lenders of ordinary farm operating capital, but not of credit for expansion except for the limited scope of the Farm Improvement Loans Act.

The evidence would indicate that such short-term operating capital might be most effectively handled for the early farm development period by the mortgage lender as a separate service that could be supported by the loan supervision services already established for mortgage lending.

In the Maritimes, the preparation of a suitable area of land for a large-scale cropping or forage enterprise usually requires substantial financing. This is because the podzolized soils are usually infertile and require much lime and fertilizer, initially, to fit them for optimum production. Financing is also required because much of the land usually needs to be consolidated into larger fields, and this frequently requires drainage, removal of stones, fence-rows, etc., to fit it for efficient production with large-scale machines. Special provision may need to be made for the initial financing of such enterprises because in many cases the cost of preliminary preparation may run as high as \$150 per acre, or more. If such improvements are required for 600 acres for one enterprise an addition of \$80,000 would be made to capital costs, a very heavy burden indeed.

1/ See Carr (1962) ch. 3 and 4, and Booth, Retson and Heighton (1967) p. 46 and following.

2/ This would probably exclude 90 per cent of the farmers in the Maritimes because so few have been accustomed to borrowing from the banks.

Special provision should be made also for financing large-scale agricultural enterprises that do not require much land. Since an increasing share of Maritime agricultural enterprises are likely to be of this type in the future, adequate credit and financing services should be available to meet their needs. Encouragement should be given to the Industrial Development Bank to extend its role in this field.

Yet if credit services, either public or private, are to be both adequate and successful in the Maritimes a great deal more information needs to be gathered on the potentials of the various enterprises, on improved methods of management appraisal, on the precise costs and benefits of various improvements like drainage, liming, etc., and many other questions on financing. Further studies in these areas should be carried out as soon as possible as a means of providing the information necessary for developing adequate credit policies for the several provinces.

9. CURRENT STRUCTURE OF MARKETS

Markets for - and marketing of - farm products comprehend a great variety of things: marketing facilities (including storage, auctions, transportation and grading stations) primary marketing agencies, wholesaling and retailing, grades and grading, buying and selling, the qualities of particular products and the markets for each, among others. The Maritime provinces have long needed an effective appraisal of all these aspects of the marketing of farm products. In the present study the structure of marketing and its problems as well as market potentials are examined, but further research in marketing appears essential.

The central feature of marketing in the Maritimes or elsewhere is the buying and selling, that is, the agreement on conditions under which the exchange of farm products at a particular price is acceptable to both seller and buyer. An acceptable price to the seller is one which will cover his costs and provide a reasonable profit. An acceptable price to the buyer is one which will enable him to sell the product to the consumer for an amount that will cover his costs and services and leave a satisfactory profit. Usually the so-called "marketing problems" range through this whole structure of marketing from the producer to the consumer. Thus problems may seem to arise because the farmer's costs are too high for him to sell at a reasonable profit. They may arise from the unevenness of quality or supply going to market. Marketing problems may be found in the facilities, agencies or services that marketers require. They may also arise at the retail or consumer end where changes in final demand or poor handling may affect the amount consumers are willing to take at a given price.

These considerations indicate the nature and wide range of marketing "problems" that occur in Maritime agriculture as a whole. Similar problems may be found in the marketing of each farm product individually. While it is not possible to deal with all these marketing problems, some of the more persistent can be examined.

One continuing problem is that local markets are mostly small and frequently scattered. These small markets are seldom as insistent on quality as larger markets, and higher-quality standards may not be adequately encouraged or co-ordinated. For some Maritime products for which only the surplus is shipped to markets in other regions, the quality standards will ordinarily be too low for most profitable marketing. For other products like potatoes, frozen vegetables, etc., that are largely exported out of the region, special costs must be incurred and controls established to ensure that quality is always high, consistent and dependable. It is the experience of all major exporters (like those of Sunkist oranges, Australian wool, etc.), that this consistency of export quality must be established at the grower level, with the several qualities being sorted out before the

product leaves his control because, on the one hand, he has the greatest interest in maintaining high quality, and, on the other, he needs to have first-hand evidence of the deficiencies in quality that he must ensure are remedied.

Ordinarily, it is a great advantage to have the market for farm products in close proximity to the producing areas. The lack of proximity between farming areas and consuming areas has been a disadvantage to Maritime farming. For farm products that are exported the markets are, ordinarily, hundreds of miles away. Even markets within the region are seldom close to the producing areas. This makes it more difficult to co-ordinate the quality and quantity that goes to market, and prices suffer accordingly. This lack of close liaison with consumer preferences creates difficulties also in adapting farm products as closely and promptly to consumer demand as may be desirable. Only when the volume is great enough to warrant having a special agency to carry out this task for the growers can quality and uniformity be adequately maintained.

The small scale of individual producers and the smallness of the total volume of most farm products are substantial handicaps in Maritime marketing. The output of many small producers when combined for market is usually uneven and undependable in quality. Such farm products frequently require careful sorting and grading to bring their quality up to a satisfactory consumer level. If, in addition, the total volume is small, as is frequently the case in many local markets in the Maritimes, the volume will be inadequate to support the ordinary and special marketing agencies and services necessary. Thus many Maritime markets have too few agencies and services for a satisfactory competitive market and many have inadequate facilities and services because the volume is too small to support more.

Transportation costs tend to be high because of the small volumes marketed, because roads tend to be circuitous and more suited to tourist travel than for rapid direct commercial trucking, and because transportation equipment is frequently small in scale and relatively inefficient (Economist Intelligence Unit, 1967).

Public support for marketing has ordinarily been geared to helping the many small-scale farmers. By the late 1960's most of the farm marketings came from the few larger-scale producers but public policy had not yet provided much support for solving their marketing problems.

Improved markets and marketing services will be part of the development needed to enable Maritime agriculture to reach its most profitable potential. It may be difficult to improve these adequately for the small-volume producer, and it is likely these small-scale farmers will continue to depend on small local markets and on tourists and roadside stands for their outlets. For large-scale enterprises the volumes produced are

likely to be large enough to warrant suitable marketing services. Special steps may need to be taken to provide the services needed, which can usually be more readily organized when each operator is of substantial size. Larger volumes also keep unit handling costs and other marketing costs low.

Yet improvements in marketing must be preceded by adequate analysis of marketing conditions and alternatives. One of the greatest deficiencies found in available information about Maritime agriculture was in the field of marketing. A number of special studies should be undertaken to examine the marketing alternatives and market potentials for major products and enterprises in each province and in the region. The amount of this market research needed seems very great now because it is essential that it be careful analytical research designed to solve problems of both present and potential marketing. Yet it may be expected that when effective research has demonstrated its ability to clarify and resolve the marketing problems for one or two of the major products the rest of the research may follow along without much difficulty. Such problems as the excessive number of processing plants in New Brunswick or the possible addition of suitable livestock auctions throughout the Maritimes or the potential for expansion of frozen vegetable markets may all be effectively solved and thus give both producers and administrators alike new hope for the potential elimination of such problems. Yet the solution of these marketing problems may be economically significant only when they are related to potentially profitable enterprises based on adequate consumer markets. The latter are examined next.

The Structure of Market Potential

The opportunities for profitable production of agricultural products in the Maritime provinces are related, on the one hand, to the costs of production and marketing, and on the other, to the prices that the markets will return to the farmers. If costs are low enough to yield a profit at available market prices then there is an opportunity for production. It is frequently assumed that the markets for Maritime farmers include not only all of the Maritime consumers but also some markets in the rest of Canada and in other importing countries. But it is only to the extent that Maritime farm costs are low enough to yield a satisfactory profit at going market prices that even the local markets are open to Maritime farmers. With this proviso, the potential markets may be examined.

The markets with the greatest potential are related to those enterprises in which Maritime farmers have the greatest competitive advantage. In the following analysis of markets the products of these enterprises will be given special attention. This is because only those products in which Maritime farmers enjoy a competitive advantage can be expected to find a satisfactory market whether such market is local, national or export. Those products with a competitive advantage, like potatoes, will

find all three markets open. Those without a competitive advantage may expect to find none of them open. It follows that the market for farm products in the Maritime provinces can be called the exclusive preserve of Maritime farmers only if their costs are low enough to compete in local markets.

For those products in which there is a competitive advantage the potential market is related to the pattern of consumer demand. The potential consumer demand can be indicated by consumption trends. Trends in food consumption are available in adequate detail only for Canada as a whole, but they provide useful guides for markets other than national markets. For example, per-capita consumption levels for Canada may provide useful first approximations to per-capita consumption for the Maritime provinces, although the per-capita consumption in the Maritimes may be affected by the greater proportion of population in rural areas and by their lower levels of income.

The market for farm products tends also to expand with the growth of population. The growth of population in the Maritime provinces is expected to be slower than in the rest of Canada and local markets may thus be expected to expand less than national markets. Population of the Maritime provinces is expected to increase over the next 13 years at an estimated rate of 0.65 per cent per year, or from a total of 1,481,300 in 1966 to 1,616,100 in 1980 (Table 9-1). The population of Canada is expected to increase in the same period at a rate of 1.8 per cent per year, or almost three times as fast.

Market demand may also shift from one food product to another as consumer preferences change. A major influence for change in consumer preferences for food has been the increase in consumer incomes. As incomes increase, consumer demand tends to shift away from the lower-cost cereal grain foods and toward the higher-cost red meats, fruits and green and leafy vegatables. This is illustrated in the per-capita consumption trends in Canadian food products. A projection of these per-capita food consumption trends for Canada to 1980 has been prepared by the Dominion Bureau of Statistics and the Economics Branch, Canada Department of Agriculture (Table 9-2). The decline in per-capita consumption of cereals, potatoes and, to a lesser extent, dairy products, is evident from the 1949-1951 period to 1964. The increase in fruits, vegetables, beef and poultry is significant. The total weight of food consumed changed very little, but its composition altered quite rapidly. For Maritime farming, significant features of these consumption trends are the declines in dairy products and potatoes (both quite moderate declines) and the increases in consumption of fruits, vegetables, poultry and concentrated milk.

A rough approximation of the potential market for food products in the Maritime provinces by 1980 might be estimated (Table 9-3) by using the per-capita consumption rates for Canada

TABLE 9-1

Population, Maritime Provinces, 1966, and Estimated Population, 1980

Province	1966	1980
	------ 000	------
Prince Edward Island	108.5	118.4
Nova Scotia	756.0	824.8
New Brunswick	616.8	672.9
Total	1,481.3	1,616.1

Source: Census of Canada, 1966. Projection to 1980 estimated at 0.65 per cent increase per annum. This crude estimate of the rate of population increase is based on forecasts by the Atlantic Provinces Economic Council and the Atlantic Development Board (the latter unpublished), but represents a combination of the two. The annual increase of 0.65 per cent is only slightly less than that for the Maritime provinces (taken together) in the two studies (APEC 0.7 per cent and ADB 0.8 per cent). The smaller rate of increase was used because by 1967 it was evident that both studies had overestimated the population growth to 1966 when it could be compared with census data. The growth rates for individual provinces differed substantially in the two studies, but here the same rate (0.65 per cent) has been applied for each province.

in 1964 (Table 9-2),[1/] and the estimated population for 1980 (Table 9-1). In most cases, such an approximation will be reasonably accurate but, in the case of dairy products the probability of error may be evident. Consumption of dairy products in the Maritimes was not increasing, even with their modest population increase. Yet, according to Table 9-3, it should reach 1,477 million pounds by 1980, an increase of over 50 per cent from the 930 million pounds produced in 1965. Beef consumption in the Maritime provinces might be expected to rise to about 127 million pounds by 1980 (Table 9-3).

1/ Because of present deficiencies in per-capita income and less urbanization it may be estimated that the consumption pattern of the Maritime provinces in 1980 will approximate that of Canada as a whole in 1964.

TABLE 9-2

Annual Per-Capita Food Consumption, Canada, Selected Years, 1949-1964, with a Projection to 1980

Item	Basis	Annual Per Capita Consumption 1949-51	1959-61	1964	1980	1980 as % of 1959-61
		lb.	lb.	lb.	lb.	%
Cereals	retail weight	171.7	153.1	145.7	126.0	82.3
Wheat flour	" "	153.1	135.6	127.1	111.0	81.9
Potatoes	fresh equiv.	164.3	156.0	155.7	144.0	92.3
Sugars & syrups	retail weight	109.5	108.9	109.7	109.0	100.1
Sugar	" "	99.5	97.8	98.3	98.0	100.2
Pulses & nuts	" "	11.4	10.3	10.4	9.0	87.4
Oils & fats (excl. butter)	" "	27.5	31.8	31.9	39.0	122.6
Fruits	fresh equiv.	153.0	186.6	179.0	225.0	120.6
Fresh	" "	90.2	97.0	102.0	103.0	106.2
Processed	" "	62.8	89.6	77.0	122.0	136.3
Vegetables	" "	135.3	159.3	160.1	209.0	131.2
Fresh	" "	71.8	83.0	80.5	102.0	122.9
Processed	" "	63.5	76.3	79.6	107.0	140.2
Dairy Products	retail weight	451.6	411.6	393.5	353.5	85.8
Fluid milk & cream	" "	389.1	344.7	321.6	266.0	77.2
Butter	" "	21.9	17.2	19.0	13.0	75.6
Cheese	" "	6.1	8.4	10.2	14.0	166.7
Concen. whole milk	" "	18.9	19.7	18.3	17.0	86.3
Concen. by-product	" "	5.3	9.4	11.5	25.0	266.0
Ice cream	" "	10.3	12.2	12.9	18.0	147.5
Dairy Products	milk equiv.	1,028.0	895.8	913.8	791.0	88.3
Meat	carcass weight	129.8	141.3	149.1	168.7	119.4
Beef	" "	52.3	68.4	78.5	98.0	143.3
Veal	" "	8.9	6.9	6.9	7.0	101.4
Pork	" "	56.2	53.1	52.0	49.0	92.3
Lamb & mutton	" "	2.3	3.1	3.4	3.7	119.4
Other	" "	10.1	9.8	8.3	11.0	112.2
Poultry	evisc. weight	16.6	29.7	34.5	46.0	154.9
Fowl & chicken	" "	13.7	21.9	25.3	32.0	146.1
Turkey	" "	2.5	7.2	9.2	13.0	180.6
Eggs	retail weight	29.5	34.4	32.2	31.0	90.1
Total food		1,400.2	1,423.2	1,401.8	1,459.7	102.6
Disposable income per capita	1949 $	901	1,068	1,196	1,782	166.8

Source: Adapted from F. Shefrin and Z. Yankowsky, A note on long-term agricultural demand projections. Can. Farm Economics 1 (5): 12-16, 1966. Table 1, p. 15.

TABLE 9-3

Estimated Food Consumption, 1980

	Canadian Consumption Per Head 1964	P.E.I.	N.S.	N.B.	Maritimes
	lb.	----------	000,000 lb.	--------------	
Cereals	145.7	17.3	120.2	98.0	235.5
Wheat flour	127.1	15.0	104.8	85.5	205.4
Potatoes	155.7	18.4	128.4	104.8	251.6
Sugars & syrups	109.7	13.0	90.5	73.8	177.3
Sugar	98.3	11.6	81.1	66.1	158.9
Pulses & nuts	10.4	1.2	8.6	7.0	16.8
Oils, fats (excl. butter)	31.9	3.8	26.3	21.5	51.7
Fruits	179.0	21.2	147.6	120.4	289.3
Fresh	102.0	12.1	84.1	68.6	164.8
Processed	77.0	9.1	63.5	51.8	124.4
Vegetables	160.1	19.0	132.0	107.7	258.7
Fresh	80.5	9.5	66.4	54.2	130.1
Processed	79.6	9.4	15.7	53.6	128.1
Dairy products	393.5	46.6	324.6	264.8	635.9
Fluid milk & cream	231.6	38.1	265.3	216.4	519.7
Butter	19.0	2.2	15.7	12.8	30.7
Cheese	10.2	1.2	8.4	6.9	16.5
Concen. whole milk	18.3	2.2	15.1	12.3	29.6
Concen. milk by-prod.	11.5	1.4	9.5	7.7	18.6
Ice cream	12.9	1.5	10.6	8.7	20.5
Dairy prod. milk equiv.	913.8	108.2	753.7	614.9	1,476.8
Meat	149.1	17.7	123.0	100.3	241.0
Beef	78.5	9.3	64.7	52.8	126.9
Veal	6.9	0.8	5.7	4.6	11.2
Pork	52.0	6.2	42.9	35.0	84.0
Lamb & mutton	3.4	0.4	2.8	2.3	5.5
Other	8.3	1.0	6.8	5.6	13.4
Poultry	34.5	4.1	28.5	23.2	55.8
Fowl & chicken	25.3	3.0	20.9	17.0	40.9
Turkey	9.2	1.1	7.6	6.2	14.9
Eggs	32.2	3.8	26.6	21.7	52.0
Total food	1,401.8	166.0	1,156.2	943.3	2,265.4

NOTE: Lines and columns may not add exactly due to rounding.

Source: Table 9-2; Canadian consumption per head, 1964, multiplied by estimated population 1980 from Table 9-1. Consumption per head for Canada in 1964 was used instead of projected 1980 consumption per head, because it was considered that this would be more accurate in reflecting Maritime consumption patterns.

At the same time, the market for farm products in the rest of Canada may be expected to expand greatly by 1980 (Table 9-2). The market for Maritime products in the rest of Canada may be expected to be quite significant for such products as potatoes, vegetables, fruits and some specialty crops. It will be less significant for dairy products, hogs, poultry and other products on which the competitive advantage may be smaller.

Agricultural export markets are important to the Maritime provinces, although the Maritimes are less dependent on export markets than are other agricultural regions of Canada (Table 9-4). The major export markets are currently for potatoes and apple products (Tables 9-5 and 9-6). A good deal more work needs to be done on the potential export demand for farm products from the Maritime provinces before the export trends can be effectively estimated. The probable continuing demand for particular commodities must remain uncertain until more information is available. The limited data now gathered (Table 9-4) show some extreme variability in year-to-year exports.

TABLE 9-4

Value of Total Production, Agricultural Production and Agricultural Exports, Canada and Maritime Provinces, 1960 and 1962

	Canada		Maritime Provinces‡	
	1960	1962	1960	1962
	$ 000,000			
Value of Total Production	25,857.0	40,081.0	1,749.0	1,893.0
Value of Agricultural Production	2,043.1	2,443.1	82.5	64.1
Value of Agricultural Exports	922.7	1,149.8*	21.4	23.6
Agricultural Exports as % of total Agricultural Production	45%	47%	26%	37%

* Canada Year Book

‡ Assuming that virtually all exports of agricultural products from the Atlantic provinces are shipped from the Maritime provinces.

Source: Adapted from J.F. Earl, The exports of the Atlantic provinces, Atlantic Provinces Research Board, Fredericton, 1964; R.K. Fletcher, Postwar agricultural trends in the Atlantic provinces, Research paper no. 3, APEC Research Centre, Fredericton, 1966; Dominion Bureau of Statistics.

TABLE 9-5

Value and Disposition of Agricultural Output by Commodity, Atlantic Provinces, 1960

Commodity	Cash Income	To Other Canadian Provinces		To Foreign Countries		Remaining in Atlantic Provinces	
	$ 000	$ 000	%	$ 000	%	$ 000	%
Oats	890	-	-	-	-	890	100.0
Potatoes	29,191	17,843	61.1	4,141	14.2	7,207	24.7
Fruit	4,860	166	3.4	1,246	25.6	3,448	71.0
Blueberries	1,240	90	-	612	-	538	-
Strawberries	1,215	-	-	40	-	1,175	-
Apples	2,301	76	-	594	-	1,631	-
Other Fruits	104	-	-	-	-	104	100.0
Vegetables	2,765	13	0.5	230	8.3	2,522	91.2
Misc. Agric. Products	1,923	-	-	-	-	1,923	100.0
Clover & Grass Seed	54	-	-	-	-	54	100.0
Hay & Clover	210	-	-	-	-	210	100.0
Tobacco	25	13	52.0	-	-	12	48.0
Total Crops	39,918	18,035	45.2	5,617	14.1	16,266	40.7
Cattle and Calves	16,960	612	3.6	266	1.6	16,082	94.8
Hogs	9,727	3	0.1	20	0.2	9,704	99.7
Sheep & Lambs	1,000	117	11.7	2	0.2	881	88.1
Poultry	5,819	-	-	-	-	5,819	100.0
Eggs	13,597	14	0.1	85	0.6	13,498	99.3
Dairy Products	30,127	-	-	-	-	30,127	100.0
Wool	297	287	96.6	-	-	10	3.4
Honey	71	-	-	-	-	71	100.0
Furs	1,455	1,455	100.0	-	-	-	-
Total Livestock & Products	79,053	2,488	3.1	373	0.5	76,192	96.4
Maple Products	88	-	-	-	-	88	100.0
Forest Products	8,103	-	-	-	-	8,103	100.0
Deficiency Payments	81	-	-	-	-	-	-
Total	127,243	20,523	16.1	5,990	4.7	100,730	79.2

Source: Levitt, K., Agriculture in the Atlantic Provinces, inputs and outputs, 1960. Unpublished.

TABLE 9-6

Agricultural Exports of the Atlantic Provinces, 1960, 1961 and 1962

	1960		1961		1962	
			$ 000			
Live Animals		540		472		519
Meat & Meat Products		2,776		2,021		1,753
Dairy Products		2,216		2,611		1,667
Cheese	53		70		73	
Milk Powder - whole	1,427		2,122		954	
Milk Powder - skim	475		79		396	
Milk Evaporated	139		178		163	
Eggs in Shell	101		84		53	
Other	21		78		28	
Cereals & Cereal Prod.		2,347		1,687		1,809
Fruit & Vegetable Prod.		9,649		9,754		14,693
Apples - Fresh	1,869		1,947		2,673	
Blueberries - Fresh	494		479		401	
Other Fruit - Fresh	42		38		58	
Frozen Fruits, Berries	874		630		733	
Apple Juice	314		300		171	
Other Juices	-		2		5	
Canned Apples	77		330		898	
Canned Peas	9		10		154	
Other Canned	64		54		64	
Nuts	34		38		61	
Onions & Shallots	34		442		487	
Potatoes - Seed	3,098		3,422		4,436	
Potatoes - Other	1,859		1,194		3,826	
Turnips	302		220		144	
Other Fresh	85		81		76	
Frozen Vegetables	283		328		149	
Canned Veg. & Juices	127		109		104	
Pickles & Dressings	84		130		253	
Other Food & Feed Prod.		3,842		2,315		3,138
Total Agric. Exports		21,370		18,860		23,579
Total Exports		411,312		446,605		469,733
Agric. as % of Total		5.20%		4.22%		5.02%

Source: Earl, J.F. The exports of the Atlantic Provinces. Atlantic Provinces Research Board, Fredericton, 1964.

Appraisal of Marketing Problems

Agricultural marketing, because of the nature of the physical and economic conditions in the Maritimes, may be expected to continue to be a source of problems. Marketing problems seem excessively important and pressing at this time because so little has been done to analyse them adequately or even to describe them accurately.

Unfortunately, many of the so-called marketing problems are, more accurately, production problems and relate to the competitive disadvantages of the Maritime farm enterprise either in costs of production or in transportation or similar handicaps. Because, under these circumstances, markets will not yield such farmers a profitable price, it has been frequently suggested that they have "marketing problems". In fact, this is a relatively superficial conclusion. Their problems are related, not to marketing, but to production, particularly to comparative costs of production.

The problems of marketing lie rather in the lack of adequate facilities, agencies and supporting services for marketing. This lack may be explained partly by the relatively small volume of many products produced for the market. It may be explained partly by the lack of understanding of the nature of the marketing problems and the lack of good analytical research designed to provide that understanding.

Effective marketing research, perhaps as much as any other research, can make a major contribution to the future success of agriculture in the Maritime provinces. This is because effective marketing research can appraise all the factors, favourable and unfavourable, encountered as the product moves from the farmer to the consumer. In this way, research can provide the information to remedy the defects and to profit by the advantages. Yet market research is not of much value unless it is competently carried out. In this respect the so-called "market research" that is concerned only with product promotion may often do more harm than good. Marketing research of a thorough and comprehensive nature is usually required to do the job properly.

A review of the marketing of farm products in the Maritimes shows there are many disadvantages to be overcome to make Maritime agriculture as competitive as possible. One disadvantage relates to the problems of many small producers and their limited volume of production. These problems may be expected to lessen over time as many older farmers retire from farming and their small farms are consolidated into larger units, or abandoned.

To remedy the defects in marketing facilities, agencies and other services will require much careful research. In planning and carrying out such research it needs to be recognized

that many problems of marketing services arise because the volumes of farm products are too small for most efficient marketing operations. Because of this, special measures - including monopoly privileges to marketing boards or co-operatives - may at times be economically warranted as a means of trying to keep marketing costs low.

Competent analytical research in farm marketing is scarce. Yet the marketing of almost every major farm product in the Maritime provinces requires this kind of careful, analytical appraisal to adapt it to the new conditions now found in farm enterprises and in consumer markets. Comprehensive analytical research particularly in the marketing of milk, potatoes, vegetables, fruits, livestock, and some other products will yield valuable benefits to farmers.

Particular features of marketing also require effective research. Among these are transportation services. The improvement of transportation services in the Maritimes is of critical importance for the future development of agriculture. Severe competitive disadvantages are imposed by local transportation services, but these are not generally recognized. They are substantial in terms of circuitous and time-consuming market roads,1/ inefficiencies of the small-scale trucking equipment in use, irregular and uncertain transport services, ferry services that impose costly delays and uncertain deliveries, location of producing enterprises at excessive distances from markets and such. Many of these defects of transportation could and should be remedied by public action. In both Nova Scotia and New Brunswick farmers are disadvantaged by not having more direct routes to their markets. In New Brunswick the location of the milk processing market needs reorganizing. In Nova Scotia, much hog production is located unnecessarily distant from the sources of feed and slaughtering and from consumer markets, and these inefficiencies are supported by a subsidy to equalize the costs of transporting hogs to market.

In Prince Edward Island, the major transportation defect is in the excessive delays and uncertainties imposed on farming by the existing ferry services. The future of farming on the Island turns to a major extent on whether effective improvements to such services can be provided in the relatively near future. If they can, Prince Edward Island promises to be a major supplier of farm products for the Maritime region. If they cannot, agriculture in Prince Edward Island can be expected to decline. One of the most promising avenues for farm production on the Island lies in perishables (fresh milk, frozen vegetables and fruits). Yet services no better than the present can destroy most of the opportunities in perishables. Let there be only one or two delays or failures to deliver as promised and chain stores and other buyers will seek supplies elsewhere.

1/ See Economist Intelligence Unit (1967) Vol. I, p. iv and 45; Vol. II, p. iv *et passim*; Vol. III, p. i *et passim*.

The evidence shows that with present services such delays occur, especially in winter months in Island services. The Island economy must depend on exports for its growth and expansion and, unless transportation services are adequate for this purpose, no stimulus to the internal economy can be very effective.

A valuable contribution in research would be made by fuller appraisal of potential demand for Maritime farm products both within the Maritime provinces and outside. In this study it was possible only to explore the nature of the differences in demand and to suggest ways of appraising the unique characteristics of demand imposed by less urbanization, lower incomes and slower-growing population in the Maritimes than in other regions. A careful appraisal of potential demand for each of the provinces is desirable.

Such an appraisal of demand should include an appraisal of prospective prices and indicate whether such prices may be profitable to Maritime farmers. Because Maritime farm enterprises are burdened in many cases with substantial disadvantages, their costs of production tend often to be higher than the costs of similar enterprises in competing regions. Accordingly, only for those enterprises in which the Maritime provinces have a comparative advantage or in which their costs are below the delivered costs of competitors can the Maritime market for farm products be profitable to Maritime farmers. This limitation needs to be more widely recognized by those concerned with agricultural development in the Maritimes.

10. THE PROFITABILITY OF ENTERPRISES

The foregoing chapters have provided a comparative appraisal of the agricultural potential generally in New Brunswick, Nova Scotia and Prince Edward Island. This appraisal examined the resources available, the organization and institutions, the trends in farming and the basic problems in Maritime agriculture. The study turns now from these broad considerations to the more specific appraisal of enterprise potentials. For this purpose, a comprehensive analysis of enterprises was undertaken to assess the types and scales of farm enterprises that were likely to prove most profitable in operation. This comprehensive analysis of enterprises has been reported in detail in a technical appendix to this report. In this chapter the results of that enterprise analysis are summarized.

An appraisal of the comparative profitability of enterprises was conducted on the basis of budget analyses of specialized enterprises. This budget type of analysis requires a comparison of inputs and outputs, in physical and value terms, for the various sizes of a particular farm enterprise, in the various locations selected, to arrive at the most satisfactory size in terms of net returns to the operator. The analysis was carried out for each of the significant farm enterprises in the Maritime region and includes comparisons of enterprises within each province, within the region and between the Maritimes and other regions.

Each of the enterprises analysed was, in the main, handled as a specialized single-enterprise farm. This technique was not just for convenience of calculation. The advantages of specialization are well recognized in agriculture and, with the new agricultural technology, specialization has become increasingly essential for the most profitable farming. This does not suggest that some complementary enterprises, like potatoes and grain, cannot be both suitable and profitable.

The enterprises analysed in the study comprised the major enterprises in current Maritime agriculture and others which appeared to have good growth potential. They included: dairy, beef, hogs, poultry, potatoes, tree fruits, strawberries, blueberries, feed grains, forages, processing vegetables and greenhouses, as well as some information on tobacco.

The analysis of each enterprise was carried out in two stages. The first or initial stage had as its basis the operations of existing enterprises in each province. This initial enterprise was then expanded into a second or "optimum" stage for which the scale was determined where possible by the size that would enable the operator to attain certain specified objectives of income, leisure and social amenities. It was assumed that suitable managerial skills were available or could be developed and that levels of productivity and efficiency would rise where warranted.

In general, it was not possible to use provincial averages as the basis for the structure of particular types of enterprises. Ordinarily, the average scale of enterprises in the Maritimes was found to be too small to provide a suitable and feasible basis from which to expand to the optimum. In a number of cases the initial-stage enterprise was structured on the basis of the average of the 10 or 20 per cent of the particular provincial enterprises that were largest in scale. This should not be interpreted to mean that these initial-stage enterprises were economic units providing both a satisfactory return on capital and an adequate labour income. They should better be considered as enterprises having sufficient collateral to qualify for a long-term loan which would allow for enough expansion to make the enterprise eventually viable and sound.

The second step in the budget analyses of enterprises was concerned with expanding the initial scale into an "optimum" scale. Optimum-scale enterprises were designed to fulfill three main objectives designed to provide satisfactory economic and social benefits to the operator. The three objectives were: (1) that the labour force including the operator have as much leisure time as persons in non-farm occupations; (2) that the operator's income be comparable to that obtainable in other occupations requiring similar levels of management, technical competence and capital investment; and (3) that the operator and his family should have access to reasonably comparable social amenities.1/

For the first objective, it was concluded that roughly a 40-hour, five-day week, with two to three weeks vacation with pay should satisfactorily provide comparable labour requirements.

For the second objective, it was concluded that the net-income level of the operator of the optimum-scale enterprise should approach the income that he might be expected to earn in alternative employment. This income from alternative employment was, as a first approximation, based on the average level of incomes of non-farm families in Canada in 1963 (Table 10-1), or $6,000 per family. This level was substantially lower than the average in Ontario ($6,571) where most such alternative employment might be found.

1/ "Comparable social amenities" may be defined as educational and other social services, commercial, recreational and cultural opportunities and other services, on a basis reasonably comparable to those ordinarily available to urban dwellers. It was assumed that achievement of the income objective would provide reasonable access to these social amenities for the majority of farmers. However, in situations of isolation or unusual distance from services, extra compensation would have to be added.

TABLE 10-1

Incomes of Non-Farm Families in Canada
By Region, 1961 and 1963

Region	1961	1963
	$	$
Atlantic	4,156	4,375
Québec	5,294	5,899
Ontario	5,773	6,571
Prairies	4,836	5,478
British Columbia	5,491	5,917
Canada	5,317	5,939

Source: Incomes, assets and indebtedness of non-farm families in Canada, 1963; Distribution of non-farm incomes in Canada by size, 1961. D.B.S. 1966.

An income objective of $6,000 is, however, much higher than average non-farm incomes in the Maritimes and very much higher than the average Maritime farm income. In most regions in Canada, the average income of farm workers is about half that of non-farm workers but in the Maritimes farm workers receive only about one-third the non-farm level. If it was desired to raise Maritime farm incomes to the level of non-farm incomes in other regions, it may be noted that they would need to be multiplied about four times to reach the level of non-farm incomes in Ontario and western Canada. The $6,000 income established as a basic criterion does not quite reach that far, but it closes most of the gap.

For the third objective, that access to comparable social amenities be available, it was concluded that, to the extent the farm enterprise was isolated, compensating additions to net income would be necessary to permit adequate access to such amenities. In this context, additional income may be necessary to send children away to schools, to provide extra leisure, to provide more entertainment and recreation near or away from home. Thus, the provision of comparable social amenities may require the addition of several thousand dollars to net income if the enterprise is isolated.

Budget Analysis as a Research Technique

The budget analysis is a tool for quantitative analysis used in business or farm planning to compare the effects of changes in inputs and outputs on the costs and revenues of an enterprise and to show thereby the net effect of such changes

on the income of the operator. In this sense, the budget is simply a convenient technique for making a quantitative appraisal of all of the physical and economic considerations, including inputs and outputs, bearing on a particular scale of enterprise or farm. If these considerations are specified in sufficient detail, a budget can show the effect of the change in any factor on the income position of the enterprise and provide a basis for appraising adjustments to the farm plan or organization or operations that produced that outcome. Budgeting, therefore, provides a basis on which expansion alternatives for a particular initial-stage enterprise can be tested and their strengths and weaknesses identified. The budget approach to enterprise analysis requires the use of reliable input-output data. The reliability and usefulness of the budgeted results are directly related to the accuracy of the input and output data and the other relationships used. Such data must be developed on the basis of practical farm operations, by advanced and skilful physical and economic research, of which there has been much too little in the Maritimes. If Maritime agriculture is to move forward with confidence, it must have a great deal more comparative enterprise data provided by such research, for all major enterprises in each province.

Budget analysis was used in this study to give an objective, quantitative appraisal of Maritime agricultural enterprises in terms of their ability to produce satisfactory levels of income. By this type of analysis, it was possible to show the scale to which enterprises would need to expand, within various price and productivity assumptions, in order to attain particular levels of net returns. In some cases, the budgets indicated that such levels could not be reached under the physical and economic conditions prevailing in the region. Through the budget analysis it was possible to determine which enterprises were likely to be the most profitable and which enterprises appeared to have the greatest comparative advantage. It was also possible, by this method, to compare Maritime enterprises with similar enterprises in competing regions and thereby indicate their relative potential for expansion.

Specific locations were selected for the initial-stage enterprises. In general, these locations corresponded to the areas where particular enterprises were found most concentrated or most advantageous in each province. For example, the budget analysis of Nova Scotia dairy enterprises assumed a location in the Truro area. The Grand Falls area in New Brunswick and the Summerside area in Prince Edward Island were selected as locations for the potato enterprises. The locations selected could be described as generally the most favourable locations for particular enterprises in the province. In most cases, the precise data necessary to make economic distinctions among locations within and between provinces were not available. In particular, more data were needed on comparative physical productivity, land availability, and suitability and other such factors. Yet economic factors (differences in transportation costs, input prices, etc.)

frequently indicated where a particular enterprise was likely to be the most profitable. Where these economic factors failed to identify the most suitable location, other physical considerations (climate, topography, soil type, etc.) frequently indicated the area and location where such enterprises were most likely to enjoy success.

Several considerations were taken into account in determining for each enterprise the scale that might be deemed most suitable for an optimum-scale enterprise. Consideration was given to the size of the larger-scale enterprises of the same type in other major farming regions and to the scale of enterprise which showed the greatest net profit. Thus the optimum scale budgeted for most Maritime enterprises was generally similar to the scale of larger enterprises of the same kind in Ontario or Québec. Satisfactory income (net labour income of $6,000) was also a criterion in determining optimum scale, as examined above.

Budget Results of Enterprise Analysis

The results of the budget analysis of farm enterprises in the Maritime provinces, may be reviewed in three sequences of detail. They can be presented first as a brief summary of the optimum-scale enterprises of each type in terms of capital investment, labour requirements, gross income, net income and operator labour income of each of the 15 enterprises analysed (Table 10-2). In addition to the 15 enterprises listed, partial analyses of processing vegetable enterprises and tobacco enterprises were prepared but data were not available to complete them sufficiently for inclusion in this table.

The second statement of results of the enterprise analyses is a summary of each of the budgets for the 14 enterprises presented as an appendix to this chapter. This summary shows the inputs, outputs and income results for each of the optimum-scale enterprises together with a brief statement of conclusions. For those wishing greater detail, the complete budgets and enterprise appraisals may be found in the technical appendix to this report, available as a reference volume.

A review of the results of the enterprise analysis (Table 10-2) shows that much of the traditional small-scale farming has little prospect for continued profitability, but a number of the enterprises analysed at optimum scale showed good prospects for profitability. At the same time, those that were indicated to be generally unprofitable at optimum scale included some of the most common types of traditional farming - dairy farms producing only manufacturing milk, beef enterprises and feed grain enterprises.

TABLE 10-2

Capital and Labour Inputs and Incomes of Budgeted

Optimum-Scale Enterprises*

Enterprise	Capital (New Cost)	Labour‡	Gross Income	Net Income	Operator Labour Income
	$	no. men	$	$	$
Dairy (mfg.)	135,855	3.0	46,020	4,464	-1,380
Beef - Cow-calf	122,450	1.5	21,745	1,343	-4,657
- Feeder	125,400	1.5	120,115	-8,101	-13,201
Feed Grain	134,300	1.5	29,549	6,230	-370
Hogs - Conventional	76,300	2.0	70,090	6,213	3,485
- Weanling	96,000	2.0	46,400	4,098	498
- Feeder	70,000	2.0	164,273	9,418	7,108
Poultry - Laying	54,000	2.0	117,491	12,202	10,422
- Broiler	75,000	2.0	100,800	6,752	4,277
Potato - N.B.	105,900	2.0	45,948	12,670	8,470
- P.E.I.	151,900	2.5	66,969	19,792	13,012
Tree Fruits	106,550	1.5	40,000	12,768	7,278
Strawberries	37,150	1.5	32,000	8,512	7,068
Blueberries	20,000	1.0	22,500	6.150	5,190
Greenhouses	100,000	6.0	51,000	8,877	5,577

* The estimates of capital investment, labour force and income refer to the budgets for the basic analysis of each enterprise. Interprovincial differences in product prices, input prices, yields, marketing costs, premiums and other factors are not reflected here. Information on processing vegetable and tobacco enterprises were not included because data were not available to develop complete budgets on bases similar to the other enterprises.

‡ Does not include piecework or contract labour for tasks such as grading and packing potatoes, picking apples and strawberries, grading and packing eggs, etc.

On the other hand, dairy enterprises producing milk for fluid consumption were indicated to be satisfactorily profitable at optimum scale because of the higher price for fluid than for manufacturing milk. Beef and manufacturing milk enterprises might have some potential for profitability at optimum scale using corn silage for feed, but this would need further testing and, even though profitable, such an enterprise in the Maritimes would be less profitable than similar enterprises in (say) Ontario. Feed grain as a specialized enterprise appeared to offer little potential, but in conjunction with potatoes or hogs, in appropriate areas, feed grain was indicated to have good possibilities.

Potatoes, tree fruits, hogs and poultry were the enterprises indicated to be most profitable and dependable for future development. Maritime potatoes and tree fruits had established themselves in competitive markets outside the Maritime region. Because of this they offered possibilities for expansion greater than most enterprises.1/ Hogs and poultry enterprises showed good profitability at optimum scale but their markets were confined largely to the Maritimes and faced strong competition there from other regions.

Processing vegetables were indicated to be quite profitable although information on complete enterprises was not fully available. Viewing the long-run outlook for processed vegetables, particularly frozen products, as well as the advantages in production enjoyed in particular areas in the Maritimes, it seems evident that special attention should be given to the potential for expansion in this field, especially in potato products, cole crops and peas.

Strawberry and blueberry enterprises showed good profitability under the conditions assumed. Yet two characteristics of these enterprises may reduce their potential over the long term. One is their dependence on the continuing availability of low-cost seasonal labour for picking. The other is the tendency for their markets to be uncertain because of such factors as fluctuating prices, strong export competition, variability of quality and short season. These characteristics make their long-run potential less favourable than the enterprise analyses might indicate.

Greenhouse enterprises were indicated to have a good profit potential. It would seem likely that substantial opportunities for profitable expansion are available in greenhouse production.

1/ The effect of the devaluation of the United Kingdom pound in late 1967 on the market for tree fruit products had not become clear at the time this was written but it would undoubtedly be adverse.

Tobacco enterprises are being initiated in the Maritime provinces. Their operations had not advanced far enough to provide adequate data for an enterprise analysis, but the available evidence indicated the likelihood that optimum-scale enterprises would be quite profitable and that suitable land was still reasonably priced in 1967.

The implications of this enterprise analysis for present-day farming in the three Maritime provinces are substantial. Viewing the results of both the initial-stage and the optimum-stage appraisals, the enterprise analysis makes clear that a major proportion of Maritime farms were not profitable in terms of an adequate return to both capital and labour invested in the enterprise. Only a small proportion of the total enterprises were large enough and efficient enough to provide satisfactory returns to labour and capital. But in each of the three provinces there were excellent examples of efficient, well-managed and highly profitable enterprises that would serve as a guide to others in techniques, organization and management. At the same time, a great many of the medium-sized farms (classified as commercial farms in the census) were still relatively small and inefficient. Because these medium-sized farms were generally yielding only a low return for the operator's labour with nothing left for a return on the capital invested, it might be expected that many would not survive the retirement of their present operators.

Significance of the Enterprise Analysis

The objective of the enterprise analysis was to compare the relative profitability of the most significant farming enterprises of the three Maritime provinces as a guide for the future development of the industry. The enterprise analysis, like the earlier chapters in this report, was designed to provide the soundest possible basis from which a permanent and profitable agriculture could grow. It was not designed to be a forecast of future results of farming because conditions may change and the profitability of particular enterprises may be altered. Yet, within these limitations, it provides an indication of the anticipated outlook and a useful guide for future policies.

Most, in volume, of the agricultural production in the three Maritime provinces has already been shifted from the traditional small farm to larger-scale enterprises. It should also be recognized that within the next decade or two, farming will have shifted much more toward a relatively small number of specialized and highly capitalized farms. The successful farmer of the future will be one who maximizes his comparative advantage by technical efficiency, financial management, the use of debt as a management strategy and the use of business economics as his guide in management decisions. These large-scale enterprises will require new policies and much more highly specialized and skilled services than have been available in the past.

The trend toward expansion of enterprises is already well established. Yet the specific paths most suitable for expansion must also be established if public policies and programs are to contribute most to the immediate adjustments and the continuing adaptations that will be necessary. Some of the changes necessary to institute these adjustments have been broadly outlined. If these further changes were made it would permit further adjustments to be made that would enable farming to shift more toward the most profitable kinds of enterprises.

Thus, looking forward to the next decade or two, the enterprise analysis indicates that the enterprises in the Maritime provinces with the greatest comparative profitability are likely to be the optimum-scale specialized enterprises producing potatoes, tree fruits, hogs, fluid milk, poultry and greenhouse products. These are the enterprises that show the greatest potential.

For manufacturing milk, specialized feed grain or beef cattle enterprises, the budget analysis indicates the long-run outlook is not likely to be favourable and, unless conditions change, the potential for these is probably limited to special cases with particular advantages.

Several enterprises may be expected to offer profitable opportunities as complementary or supplementary enterprises, partly because they require only seasonal labour, partly because their risk as a specialized enterprise may be an excessive burden, and, in some cases, because of complementary benefits from joint use of labour, machinery, fertilizer, or other inputs. The enterprises comprised here include processing vegetables, strawberries, blueberries and, in some cases, feed grain.

The potential for profitable land-based farming must be recognized as limited mainly to a few types of enterprises and locations - fluid milk enterprises in the vicinity of major consuming markets; potato enterprises where the required land quality is available; and tree fruit enterprises where soil, slope and other conditions are favourable. For the many other land-based enterprises - manufacturing milk, grain, beef cattle, etc. - their lack of profitability comparable with other regions makes their outlook quite marginal and limits their long-run potential to those enterprises with special advantages. There is a possibility that corn silage, if suitable varieties can be developed, may enable more of these land-based enterprises to reach satisfactory profitability on good-quality lands.

Viewed broadly, the results of the enterprise analysis emphasize several significant features in the prospects for farming in the Maritime provinces - the reasons for the continued and rapid decline in traditional small-scale farming; the continuing opportunities for expansion in larger-scale enterprises; the uncertainties and difficulties facing all but a few of the land-based enterprises; the significant opportunities offered by

particular land-based enterprises and by many enterprises that require little land; the tendency for a larger share of Maritime farm output to be produced by fewer farmers, with more produced for the market and less for income-in-kind; the need for more-specialized farm services, not possible with the traditional agricultural representative services; the need for much more, and more competent, research in enterprise analysis, land capabilities, competitive market potentials, financial management, and many other fields; and the need for developing the new policies required for this new agricultural environment.

APPENDIX

TO CHAPTER 10

SUMMARY OF

MARITIME FARM ENTERPRISE ANALYSIS 1/

This Appendix comprises a summary of the budget analysis of optimum agricultural enterprises in the Maritime provinces. For each enterprise, a brief summary of the input-output data and the income results is presented first, and this is followed by a brief statement of conclusions arising from the analysis of that enterprise.

1/ These summaries of the enterprise analysis have been prepared mainly by B.H. Sonntag. For further details on these enterprise appraisals, reference should be made to Maritime Farm Enterprise Analysis, prepared as a technical reference volume to this report.

DAIRY ENTERPRISE

SUMMARY DATA

	Prince Edward Island	Nova Scotia	New Brunswick
Size of Enterprise (no. of cows)	75	75	75
Capital - Replacement Cost ($)		135,855	
- Average Investment ($)		97,400	
Labour Force (no. of men)		3.0	
Land (acres)		215	
Costs and Returns ($)			
Gross Income at $4.40 per cwt.	46,020	46,020	46,020
Expenditure	40,149	41,556	40,449
Net Income	5,871	4,464	5,571
Return to Capital (6%)	5,844	5,844	5,844
Operator Labour Income	27	-1,380	-273

NET INCOME AT ALTERNATIVE MILK PRICES IN NOVA SCOTIA 1/

Price Per Cwt.	Gross Income	Net Income	Labour Income
$	$	$	$
4.00	42,420	864	-4,980
4.50	46,920	5,364	-480
5.00	51,420	9,864	4,020
5.50	55,920	14,364	8,520
6.00	60,420	18,864	13,020

1/ In New Brunswick and Prince Edward Island net income and labour income would be $1,100 to $1,400 higher respectively, reflecting the lower expenditures as indicated in the table above.

Reference Notes

1. Productivity. 12,000 pounds of milk per cow, 900,000 pounds for the enterprise and 300,000 pounds per man.

2. Price. $4.40 per cwt. applicable to manufacturing milk. The effect of price on net income is indicated.

3. Expenditure. Slightly different for each province reflecting differences in feed costs, cropping inputs, taxes, etc. Available physical data permitted no distinctions between provinces on the basis of differences in productivity of the land.

4. Net Income. Slightly different for each province reflecting the differences in expenditures. Labour income could be much higher if the labour force were reduced to a point where each man put in as many hours as in 25-cow one-man enterprises. Wage rates for hired labour were estimated at $80 per week ($350 per month).

5. Mechanization. Free-stall housing, milking parlour, silos with unloaders, ground level hay storage, machinery for both hay and silage production.

OPERATOR LABOUR INCOME AT VARIOUS COMBINATIONS OF PRICE, LABOUR SUPPLY AND HERD SIZE

	Representative Combinations	Operator's Labour Income
		$
1.	75 cows, $4.40 milk, 2 hired men ($350/month)	-1,380
2.	75 cows, $4.40 milk, 1 hired man ($350/month)	2,820
3.	90 cows, $4.40 milk, 2 hired men ($350/month)	2,524
4.	90 cows, $4.40 milk, 1 hired man ($350/month)	6,724
5.	75 cows, $4.00 milk, 2 hired men ($350/month)	-4,980
6.	75 cows, $4.00 milk, 1 hired man ($350/month)	-780
7.	90 cows, $4.00 milk, 2 hired men ($350/month)	-1,800
8.	90 cows, $4.00 milk, 2 hired men ($250/month)	600
9.	90 cows, $4.00 milk, 1 hired man ($350/month)	2,400

Combinations With $6,000 or More in Operator Labour Income

1.	90 cows, $4.40 milk 1 hired man ($350/month)	6,724
2.	90 cows, $4.75 milk, 2 hired men ($350/month)	6,304
3.	90 cows, $4.50 milk, 2 hired men ($250/month)	6,104
4.	75 cows, $5.25 milk, 2 hired men ($350/month)	6,270
5.	75 cows, $5.00 milk, 2 hired men ($250/month)	6,420

Conclusions

The budget analysis of manufacturing milk enterprises indicated generally unsatisfactory levels of income for this enterprise in the Maritimes. Manufacturing milk prices are generally too low to provide satisfactory returns to both labour and capital. Labour incomes are low even in relatively large enterprises (75 to 90 cows and 900,000 to 1,000,000 pounds of milk) especially when the labour force is large enough to permit workers to enjoy the social amenities considered essential for comparable employment elsewhere. For example, with 75 cows and three men (two hired) a satisfactory level of operator labour income ($6,000 or more) was not achieved until the price of milk reached $5.00 per cwt. With a 90-cow enterprise and the same labour force this level of income was generated with a price of $4.50 per cwt. At $4.00 per cwt. an enterprise would need 90 cows and could afford only one hired man if it were to achieve this level of operator labour income.

While dairy enterprises in other areas do not enjoy particularly attractive incomes from the sale of milk at manufacturing prices, their net incomes are, nevertheless, higher than in the Maritimes. Production costs in eastern Ontario are about 10 per cent lower than in the Maritimes. The price for milk would have to be about 40 cents per cwt. higher in the Maritimes than in Ontario for similar enterprises to yield equivalent levels of income. This suggests that dairy enterprises in central Canada could achieve satisfactory labour incomes at price levels which would provide only very low labour returns in the Maritimes. The difference in production costs between the two areas is related mainly to differences in feed costs, i.e., the productivity of the land.

It is important to note here that the existence of large numbers of relatively small enterprises which produce manufacturing milk in the Maritimes and appear to have adequate incomes is generally related to the equity position of the operator. Where the operator is in a high-equity position (no debt charges) satisfactory incomes from the point of view of having sufficient income to meet living expenses can be generated at relatively low prices. When these enterprises are wholly owned and when no capital replacements are made, cash operating and living expenses can be covered, at relatively low prices for milk, by the revenue that should provide the return on capital. However, when the owner retires, dies or attempts to sell the enterprise the productivity is often too low to carry the necessary capital and depreciation costs and provide a return to labour as well, consequently it is not attractive to buyers and may have to be abandoned. Much of the land abandonment which has occurred in the Maritimes can be attributed to these considerations. Furthermore, it can be expected to continue and perhaps even accelerate over the next decade or so.

BEEF (COW-CALF) ENTERPRISE

SUMMARY DATA

	Prince Edward Island	Nova Scotia	New Brunswick
Size of Enterprise (no. of cows)	200	200	200
Capital - Replacement Cost ($)		122,450	
- Average Investment ($)		100,000	
Labour Force (no. of men)		1.5	
Land (acres)		365	

Costs and Returns ($)

	Prince Edward Island	Nova Scotia	New Brunswick
Gross Income	21,745	21,745	21,745
Expenditures	20,181	20,402	20,319
Net Income	1,564	1,343	1,426
Return to Capital (6%)	6,000	6,000	6,000
Operator Labour Income	-4,436	-4,657	-4,574

Reference Notes

1. Productivity. 200 cows to yield 90-per-cent calf crop, 450-pound steer calves, 425-pound heifer calves and 15-per-cent replacement rate.

2. Prices. Steers to sell at - $26.45 per cwt.
   Heifers to sell at - $22.56 per cwt.
   Cull cows to sell at - $16.00 per cwt.

3. Net Income. Slightly different for each province reflecting differences in expenditures for feed, cropping inputs, taxes and the like. Net income would be substantially higher if heavier feeders could be produced. It would be higher with January calving assuming a one-third increase in winter forage requirements; a 20-per-cent increase in pasture requirements; no changes in calving rate, labour force, purchased feeds, or buildings; increases in land capital, machine costs and cropping inputs and production of 650-pound steers and 600-pound heifers. In this case, net income would be high enough to pay a return on capital but there would still be no return to operator labour. With quality forage the protein supplement could be eliminated, and labour income would then be about $2,000 to $2,500.

4. Feeding and Cropping Program. Hay yields of 3.0 tons per acre, (9.0 tons of silage) pasture carrying capacity of 1.0 animal units per acre, and production of grass silage.

BEEF (FEEDER) ENTERPRISE

SUMMARY DATA

	Prince Edward Island	Nova Scotia	New Brunswick
Size of Enterprise (head)	500	500	500
Capital - Replacement Cost ($)		125,400	
- Average Investment ($)		86,000	
Labour Force (no. of men)		1.5	
Land (acres)		370	

Costs and Returns ($)

	Prince Edward Island	Nova Scotia	New Brunswick
Gross Income	120,115	120,115	125,115
Expenditure	124,166	128,216	126,952
Net Income	-4,051	-8,101	-1,837
Return to Capital (6%)	5,100	5,100	5,100
Operator Labour Income	-9,151	-13,201	-6,937

Reference Notes

1. Productivity. 500 steers at 450 pounds making 600 pounds of gain over a 300 to 320-day feeding period.

2. Selling Prices. Feeder calves - $26.50 per cwt.
   Slaughter steers (good) - $40.75 per cwt. (dressed)

3. Net Income. Differences among provinces reflect differences in costs of feed grains, taxes and cropping inputs. The higher gross income for New Brunswick reflects the $10-per-head premium paid on slaughter animals grading Standard or better.

4. Feeding Program. Grass silage, purchased grain, forage: grain ratio 2:1 (by weight on hay and grain basis).

5. Alternative Feeding Program. Budget for a feeder enterprise based on feeding corn silage to yearling dairy steers indicated an operator labour income of about $5,000. This budget was based on the following assumptions: Purchasing 700-pound steers at $20.63 per cwt.; selling 1,100-pound steers (605 pounds dressed) at $37.40 per cwt. dressed; two lots of 300 steers per year at 2.25 pounds of gain per day; and corn silage yields at 15 tons per acre with the following inputs: fertilizer - $20 per acre; seed - $3.50 per acre; chemicals - $12.50 per acre; tractor inputs - 6.0 hours per

acre; and protein supplements - $3.50 per ton of corn silage. Yields of 12 tons per acre with the same cropping inputs gave a labour income of $2,500.

6. Ontario Enterprise. 500-head enterprise feeding 250 calves and two lots of 250 yearlings per year and based on feeding corn silage indicated a labour income of $16,000.

Conclusions

The budget analysis for beef enterprises indicated that beef production based on hay or grass silage or both, plus purchased grain, cannot be pursued in the Maritimes in profitable competition with other areas. The disadvantage of cow-calf enterprises in the Maritimes relative to other areas is related mainly to the high cost of forage production. The grain requirement for Maritime feeding adds a further disadvantage in competition with Ontario enterprises based on corn silage or with western enterprises based on cheap feed grains. There appear to be two main possibilities for profitable beef production in the Maritimes. One relates to the possibility of corn silage production in the Maritimes both for beef feeding and for providing the winter feed requirements of cow-calf enterprises. The other major possibility appears to be a feeder production system in which calves would be dropped early in the year, January or February, so that when the pasture season begins in late May or early June these calves would be large enough to utilize such pasture most effectively. These calves would be much heavier in the fall, 600 to 650 pounds perhaps, hence gross income would be higher and overhead costs of wintering cows would be spread over a larger gross. Neither of these possibilities has been effectively researched in the Maritimes and it would seem logical and desirable to examine these two possibilities on specific areas on the basis of large-scale practical farm operations such as cow-calf enterprises with 200 or more cows and 500-head feeder enterprises. However, it is unlikely that these enterprises can ever be as profitable as in Ontario and western Canada where physical conditions are more favourable.

Forage Production and Land-Based Agriculture

The analysis of beef and dairy enterprises indicated a very limited potential for these extensive-type land-using enterprises. The disadvantages of these enterprises relative to other areas are related to physical limitations (climate, soil, etc.) which make forage production more costly in the Maritime provinces. Physical data in the form of yields, yield variability, quality and input requirements under practical farm conditions are not well developed in the Maritimes. A fully satisfactory appraisal of beef and dairy enterprises is not possible without these data and since beef and dairy are the main land-using enterprises, an appraisal of land-based agriculture in total is also difficult without these data. There is, there-

fore, substantial need for physical research which would generate these kinds of data for the Maritimes. This research would need to be conducted in practical large-scale farm operations where the physical limitations bearing on such enterprises in the Maritime provinces could have their full economic impact reported.

FEED GRAIN ENTERPRISE

SUMMARY DATA

	New Brunswick
Size of Enterprise (acres)	400
Capital - Replacement Cost ($)	134,300
- Average Investment ($)	110,000
Labour (no. of men)	1.5

Costs and Returns ($)

Gross Income	29,549
Expenditure	23,319
Net Income	6,230
Return to Capital	6,600
Labour Income	-370

Reference Notes

1. Productivity. 400 acres; continuous cropping; 60 bushels per acre (barley).

2. Prices. $54 per ton (dry basis).

3. Western Grain Enterprise. Grain enterprise in prairie area of Saskatchewan with similar capital investment and labour force would have an operator labour income in excess of $10,000.

Conclusions

The budget analysis of specialized grain enterprises indicated that this enterprise is not likely to provide Maritime farmers with satisfactory levels of income. Evidence of the general unprofitability of grain production in the Maritimes is found in the existence of few, if any, farms which rely on grain as the major source of income. Limitations of climate, soil and topography make grain production relatively costly and risky in the region. As a supplementary enterprise on potato and other types of farms it may have some potential. In Prince Edward Island there is some possibility of profitable grain production in combination with large-scale hog enterprises. This possibility is related to the difference between the price received by grain producers and the price paid to feed suppliers. This potential for grain is limited to the land area suitable for grain production outside of that used by potato and fluid milk enterprises. The grain-hog combination is likely to be less profitable than either of these other enterprises and would therefore use land less suitable for them. The extent of the

land area which would be suitable is not very clearly defined at this stage but it is likely that most of it is in Prince Edward Island. Assuming that the physical productivity estimates used in the grain enterprise budget are correct (60 bushels of barley per acre under continuous cropping) about 4.0 acres of land would be required for each sow unit, i.e., 400 acres for a 100-sow enterprise.

The budget analysis of grain enterprises in the Maritimes indicated little, if any, labour income. By way of comparison, an enterprise in Saskatchewan with similar labour and capital inputs would likely provide an operator with labour income of $10,000 or more.

CONVENTIONAL HOG ENTERPRISE

SUMMARY DATA

	Prince Edward Island	Nova Scotia	New Brunswick
Size of Enterprise (sows)	100	100	100
Capital - Replacement Cost ($)	76,300		
- Average Investment ($)	45,475		
Labour (no. of men)	2.0		

Costs and Returns ($)

	Prince Edward Island	Nova Scotia	New Brunswick
Gross Income	70,090	73,383	72,442
Expenditure	63,877	65,997	63,137
Net Income	6,213	7,386	9,305
Return to Capital (6%)	2,728	2,728	2,728
Operator Labour Income	3,485	4,658	6,577

Reference Notes

1. Productivity. 100 sows, 16 weanlings per sow, 60 per cent Grade A, 40 per cent Grade B.

2. Prices. N.S. and N.B. - $30 per cwt. for Grade A hogs
   P.E.I. - $29 per cwt. for Grade A hogs
   Premiums - $ 3 per Grade A hog in N.B. and P.E.I.
   - $ 4 per Grade A hog in N.S.

3. Net Incomes. Differences among provinces reflect differences in hog prices, quality premiums, feed costs, marketing costs, taxes and other factors.

4. Alternative Production System. Operator labour income was estimated at $9,000 in Prince Edward Island for a combined grain and hog operation. This higher level of income reflects the difference between selling and buying prices for grain.

5. Similar Enterprises in Other Regions. Labour incomes of similar enterprises in Ontario and western Canada were estimated at $15,000 to $17,000. The higher incomes reflect differences in feed costs between the Maritimes and other areas.

Conclusions

The budget analysis of hog enterprises indicated generally satisfactory operator labour incomes at prices of $30 or more per cwt. for Grade A hogs. Much higher labour returns were indicated for similar enterprises in cther areas. These higher returns are due, mainly, to lower feed costs. Feed costs which are about 50 per cent higher in the Maritimes than in western Canada are partially offset by higher prices in the Maritimes but not to the extent of providing similar returns for hog enterprises in the two areas. Yet so long as wheat production in the Prairies is so much more profitable than hogs, it may be expected that major wheat regions such as Saskatchewan will leave hog production to the Maritime provinces even though net profits in hogs are higher in Saskatchewan than in eastern provinces. The risk to Maritime hog farmers lies in the possibility that wheat markets may shrink soon and wheat stocks build up again on prairie farms. If they do, expect hog prices to drop below the break-even point in the Maritimes.

A large proportion of the hog production in the Maritimes, especially in Nova Scotia, is based on freight-assisted imported feed grains. Freight assistance on feed grains would appear to be a continuing need for profitable hog production in the Maritimes except in so far as a small hog industry can be supported in Prince Edward Island and New Brunswick by grain produced as a rotation crop on potato farms. The relatively high costs in hog production in the Maritimes relative to other areas suggests only limited potential for expansion of hog production in the Maritimes and certainly no potential beyond the Maritime market.

There would appear to be some potential for combined hog and grain enterprises, especially in Prince Edward Island. This potential is related to the difference between the buying and selling prices for grain and is limited to the extent of the land area suitable for such grain production. At 60 bushels of barley per acre and continuous cropping a 400-acre grain enterprise produces the grain requirement for a 100-sow conventional hog enterprise. Without freight assistance on feed grains, hog production in the Maritimes would be limited to what could be supported by local grain production. Prince Edward Island would appear to have the greatest comparative advantage in such a situation because of larger acreages of land there, than in Nova Scotia or New Brunswick, that are suited to grain production. Hog production on this basis would be less profitable than in other regions. However, it would appear to have a comparative advantage over other livestock enterprises. This does not appear to be the case in other regions where grain, and, in some cases, beef in western Canada and beef, fluid milk and several cash crops in Ontario are favoured over hogs in terms of income, labour inputs and other factors.

A high proportion of the labour income in Maritime hog enterprises is derived from subsidies. For example, when the price is about $30 per cwt. for Grade A hogs, feeder enterprises based on purchased grains derive most of their labour income from quality premiums. In conventional enterprises about half of the labour income is derived from these premiums. In a 100-sow conventional enterprise the freight subsidy on grains and the quality premiums on Grade A hogs amount to about $11,000 per year.

POULTRY, LAYING ENTERPRISE
SUMMARY DATA

	Prince Edward Island	Nova Scotia	New Brunswick
Size of Enterprise (no. of birds)	12,000	12,000	12,000
Capital - Replacement Cost ($)			54,000
- Average Investment ($)			29,700
Labour Force (no. of men)			2.0

Costs and Returns ($)

	Prince Edward Island	Nova Scotia	New Brunswick
Gross Income	119,795	115,187	117,491
Expenditure	106,375	106,220	105,289
Net Income	13,420	8,967	12,202
Return to Capital (6%)	1,780	1,780	1,780
Operator Labour Income	11,640	7,187	10,422

Reference Notes

1. Productivity. 12,000 layers housed; mortality of 1.0 per cent per month; feed conversion of 4.5 pounds per dozen eggs and 90 pounds per layer housed; egg output of 20 dozen per layer, 65 per cent Grade A Large, 25 per cent Grade A Medium, 6 per cent Grade A Small and 4 per cent others.

2. Prices. - Grade A Large, 52.7 cents per dozen in Halifax, 1.0 cents per dozen higher in Moncton and 2.0 cents per dozen higher in Charlottetown.
   - Grade A Medium; 6.5 cents per dozen lower than Grade A Large.
   - Grade A Small, 15.0 cents per dozen lower than Grade A Large.
   - Others, no value.

3. Production System. Caged layers; purchased replacements; two-man labour force; grading, packing and delivering eggs to retail outlets, and 3,000 hours of part-time labour for grading and packing eggs.

4. Net Incomes. Estimates above are likely somewhat high because price estimates used were unweighted, mortality is lower than in some enterprises, delivery costs are lower than in other enterprises, some enterprises have larger labour forces and feed costs are higher in some locations. Differences among provinces in the estimates indicated above reflect differences in egg prices, feed costs and taxes.

5. Laying Enterprise in Other Regions. Production costs in Ontario are about two cents per dozen lower than in the Maritimes. This difference is approximately equal to the cost of transportation from the Maritimes to central Canada.

POULTRY, BROILER ENTERPRISE
SUMMARY DATA

	Nova Scotia	New Brunswick
Size of Enterprise (no. of birds)	30,000	30,000
Capital - Replacement Cost ($)		75,000
- Average Investment ($)		41,250
Labour Force (no. of men)		2.0
Costs and Returns ($)		
Gross Income	98,400	100,800
Expenditure	91,328	94,048
Net Income	7,072	6,752
Return to Capital	2,475	2,475
Labour Income	4,597	4,277

Reference Notes

1. Productivity. 30,000 broilers (120,000 per year; feed conversion of 2.2 pounds of feed per pound of live bird; production of 4.0-pound birds).

2. Prices. New Brunswick - 21.0 cents per pound live
   Nova Scotia - 20.5 cents per pound live
   Ontario - 19.5 cents per pound live

3. Net Income. Differences between provinces reflect differences in prices, feed costs and taxes.

4. Similar Enterprises Elsewhere. Production costs in Ontario are about 1.0 cents per pound lower than in the Maritimes.

Conclusions

Poultry production in the Maritimes, like a large proportion of the hog production, is based on imported feeds and its profitability is based on access to freight-assisted grains. With imported freight-assisted grains, poultry enterprises, both layer and broiler, appear able to compete with producers in other areas for the Maritime market. Production costs are slightly higher than in competing areas but generally less than the transportation costs from these areas to the Maritimes. The potential for expansion in poultry production is not large since Maritime producers are restricted mainly to the Maritime market, a market which is not growing very rapidly and one in which production and consumption are almost in balance now. There is some limited scope for enterprise consolidation but not much else. Increases in demand resulting from population growth will likely be met through increased productivity and the expansion of existing enterprises

POTATO ENTERPRISE

SUMMARY DATA

	Prince Edward Island	New Brunswick
Size of Enterprises (acres)	150	120
Labour Force	2.5	2.0
Capital - Replacement Cost ($)	151,900	105,900
- Average ($)	113,000	70,000
Land (total acres)	450	160
Costs and Returns ($)		
Gross Income	66,969	45,948
Expenditure	47,177	33,278
Net Income	19,792	12,670
Return to Capital	6,780	4,200
Operator Labour Income	13,012	8,470

Reference Notes

1. Productivity. Prince Edward Island - 150 acres of potatoes; 450 acres of total cropland; 230 cwt. per acre (140 barrels); 10 per cent shrinkage; 10 per cent seconds; and production for the table stock market.

   New Brunswick - 120 acres of potatoes; 160 acres of total cropland; 248 cwt. per acre (150 barrels); 20 per cent shrinkage on table stock; 10 per cent shrinkage on processing potatoes; and one-half of the total crop for table stock and the other half for processing.

2. Prices. Prince Edward Island - Canada No. 1 table stock - $2.06 per cwt; second - $0.70 per cwt.

   New Brunswick - Canada No. 1 table stock - $1.75 per cwt.

3. Mechanization. 2-row planters, 4-row cultivators, mechanical harvesters, bulk handling and storage facilities and grading equipment.

Conclusions

The budget analysis of the potato enterprise indicates these are the most profitable enterprises in the Maritimes. Satisfactory returns were indicated in budgets based on the production of table stock potatoes. Even higher returns were indicated for seed and processing potatoes. On table stock production, Prince Edward Island enterprises appeared to have some advantage over New Brunswick based on lower shrinkage rates and higher average prices. On processing and seed potatoes, the advantage for Prince Edward Island appears much smaller. With these latter two products, shrinkage rates are similar in the two provinces and the price differential is smaller. Higher average yields in New Brunswick further reduce the advantage of Prince Edward Island in processing and seed potatoes. Comparison of potato enterprises in the Maritimes with those in Ontario suggests that efficient Maritime enterprises will continue to compete well in central Canada markets. This ability is related to higher yields, better quality, and lower production costs in the Maritimes. In addition, in Ontario, competition from other cash crops tends to reduce the comparative advantage of potato enterprises. This is reflected in rapidly rising land costs.

The potential for expansion in potato production in the Maritimes is related primarily to increases in demand in areas outside the Maritime region. For Maritime producers this increase could come from three sources: population increase in central Canada, a larger share of the domestic market and increased exports. New Brunswick and Prince Edward Island have virtually the entire seed export market for Canada and if their quality can be maintained their advantage will likely continue. Table stock exports and exports of processed products from Canada also originate mainly in the Maritimes. Maritime producers and processors should be able to capture a large proportion of any export expansion in these products. All of these aspects of the potato market (seed exports, domestic and export table stock markets, and domestic and export markets for processed potatoes) need further study and analysis before the potential for expansion in Maritime potato production can be fully and satisfactorily appraised.

TREE FRUITS ENTERPRISE

SUMMARY DATA

	Nova Scotia	New Brunswick
Size of Enterprise (bearing acreage)	100	100
Capital - Replacement Costs ($)	106,550	
- Average ($)	91,500	
Labour Force (no. of men)	1.5	
Land (total acres)	122	

Costs and Returns ($)

	Nova Scotia	New Brunswick
Gross Income	40,000	48,000
Expenditure	27,232	31,232
Net Income	12,768	16,768
Return to Capital	5,490	5,490
Operator Labour Income	7,278	11,278

Reference Notes

1. Productivity. 100 acres at 400 bushels per bearing acre.

2. Prices. Nova Scotia, $1.00 per bushel
   New Brunswick, $1.20 per bushel

3. Net Incomes. Difference between provinces reflects higher prices and picking costs in New Brunswick. Production in Nova Scotia was assumed to be mainly for processing while in New Brunswick it was mainly for the fresh market. No differences in productivity of the land were indicated for the two provinces.

Conclusions

The budget analysis of tree fruit enterprises indicated satisfactory incomes from this enterprise in the Maritimes. Expansion in apple production in the Maritimes, like potatoes, will be based mainly on the possibilities for increased exports out of the region. Apples produced in the Maritimes are currently distributed approximately as follows:

New Brunswick - 0.5 million bushels a year to the New Brunswick fresh market

Nova Scotia - 3.0 million bushels a year
- 10 to 15 per cent exported - 75 per cent to the United Kingdom - 10 per cent to Sweden

- 65 to 70 per cent processed - 50 per cent to the United Kingdom - 50 per cent remains in Canada - 50 per cent in Atlantic region and 50 per cent to central Canada
- 15 to 20 per cent, used domestically, fresh, mainly in Nova Scotia.

The potential for expansion appears to be mainly in the processing market. Higher-quality fresh apples are produced in British Columbia, Québec and some European countries. Production costs are lower in the Maritimes than in other areas in Canada but quality is also lower. The lower production costs suggest, however, a comparative advantage in the Maritimes in the production of apples for processing. A satisfactory estimate of the potential for expansion is not available at this time. There is need for competent market research to establish this.

STRAWBERRY ENTERPRISE
SUMMARY DATA

	Nova Scotia
Size of Enterprise (bearing acres)	20
Capital - Replacement Cost ($)	37,150
- Average Investment ($)	24,075
Labour Force (no. of men including picking labour)	1.5
Land (total acres)	60

Costs and Returns ($)

Gross Income	32,000
Expenditure	23,488
Net Income	8,512
Return to Capital	1,444
Labour Income	7,068

Reference Notes

1. Productivity. 20 bearing acres at 8,000 quarts per acre.

2. Prices. 20 cents per quart for processing strawberries.

Conclusions

Available data indicated satisfactory returns from large-scale strawberry enterprises in the Maritime provinces under conditions of above-average yields, availability of seasonal labour for picking and prices of 20 cents or more per quart for processing strawberries. There is much uncertainty in all three of these conditions. Expansion in strawberry production must be based largely on exports out of the region either as fresh or processed fruit since local markets are already well-supplied with local strawberries. The profitability of strawberry production is dependent, to a large extent, on the availability of a large, seasonal labour supply for harvesting. The cost of this labour is likely to rise as incomes and employment rise and as the population of the region becomes more urbanized. This will reduce the profitability of the strawberry enterprise. This factor must be taken into consideration in any assessment of the potential for increasing strawberry production for fresh export or for processing. Maritime producers face stiff competition from other regions for both fresh and processed berries, especially from California. This suggests only limited profitability for Maritime enterprises based on production expanded for export. A fully satisfactory appraisal of the potential for expansion in strawberry production would require additional market

research. Such research should recognize that markets are not the exclusive preserve of any one province in the Maritimes hence any plans for expanded output in one province will need to take into account developments in other provinces in the region.

BLUEBERRY ENTERPRISE
SUMMARY DATA

	Nova Scotia
Size of Enterprise (acres)	200
Capital - Replacement Cost ($)	20,000
- Average ($)	16,000
Labour (no. of men, excluding picking labour)	1.0

Costs and Returns ($)

Gross Income	22,500
Expenditure	16,350
Net Income	6,150
Return to Capital	960
Operator Labour Income	5,190

Reference Notes

1. Productivity. 100 bearing acres per year, 1,500 pounds of blueberries per bearing acre, one-man labour force plus additional part-time labour for burning, spreading straw and harvesting.

2. Prices. 15 cents per pound.

3. Harvesting Costs, Picking. 5 cents per pound; containers, etc., - 0.5 cents per pound.

Conclusions

The profitability of blueberry production is highly dependent on the availability of low-cost seasonal labour. Under conditions of adequate supplies of this labour satisfactory incomes can be achieved from large enterprises. However, if the problems of unemployment, low levels of education and skill, etc., are overcome in the areas where blueberries are produced it is likely that the profitability of this enterprise will be reduced substantially. A fully satisfactory appraisal of the blueberry enterprise requires better physical production data than are currently available and some market research to indicate the potential demand for blueberries and blueberry products. Such research should pay particular attention to technological developments associated with competing products such as highbush blueberries and cherries.

GREENHOUSE ENTERPRISE
SUMMARY DATA

	Nova Scotia
Size of Enterprise (acres)	1.0
Capital - Replacement Cost ($)	100,000
- Average Investment ($)	55,000
Labour Force (no. of men)	6.0

Costs and Returns ($)

Gross Income	51,000
Expenditure	42,123
Net Income	8,877
Return to Capital	3,300
Operator Labour Income	5,577

Reference Notes

1. Productivity. 1.0 acre under glass, 10.0 pounds per plant on a spring crop of tomatoes, 5.0 pounds per plant on a fall crop, 12,000 plants per acre.

2. Prices. Spring crop - $0.30 per pound
   Fall crop - $0.25 per pound.

3. Labour. Operator plus five man-years of hired labour.

Conclusions

The budget analysis of greenhouses examined the profitability of greenhouse tomato production. In the Maritimes greenhouse vegetable production (mainly tomatoes and cucumbers) is concentrated in Nova Scotia. The expertise required for the operation and management of greenhouses has been developed there, hence it is likely that any further expansion in greenhouse vegetable production will occur mainly in that province. Greenhouse tomato production appears to be a relatively profitable enterprise and considerable scope for expansion is indicated. It is unlikely, however, that Maritime production could be expanded beyond the requirements for the Maritime market in competition with producers in other areas.

PROCESSING VEGETABLES

Conclusions

Data from vegetable processors in the Maritimes indicate that those vegetables which are climatically adapted to the region can be produced profitably there in competition with other areas. Cole crops (brussels sprouts, cauliflower and broccoli) and peas appear to be the main vegetables in which Maritime producers have a competitive advantage. The Maritime provinces are already major suppliers of these vegetables in eastern and central Canada markets. There appears to be significant potential for expansion in production of these crops, especially in Prince Edward Island and western New Brunswick where physical conditions are particularly favourable. More research is required, however, to indicate the extent of the competitive advantage of these crops in the Maritimes and the potential for expanding production for markets in Canada and elsewhere. As an enterprise for Maritime farmers processing vegetables will likely continue to be a fairly profitable supplementary enterprise on other types of farms.

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Appendix
Background
Study No **2**

MARITIME FARM ENTERPRISE ANALYSIS

Technical Reference Volume to

THE COMPETITIVE POSITION OF MARITIME AGRICULTURE

ATLANTIC DEVELOPMENT BOARD

Appendix
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ATLANTIC DEVELOPMENT BOARD

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FOREWORD

The Competitive Position of Maritime Agriculture, prepared for the Atlantic Development Board by Dr. D. Wm. Carr of Ottawa, examined the basic problems of the region's agricultural industry and appraised the industry's potential for expansion and growth. It has been published as the second in a series of background studies initiated by the Atlantic Development Board to examine important aspects of the economy of the Atlantic Region. The present study, undertaken by B.H. Sonntag under Dr. Carr's general direction, examines in some detail the comparative profitability of agricultural enterprises. It serves as a technical reference volume to the main report, in which its findings are summarized (Chapter 10).

Mr. Sonntag has used the budget method to analyse alternative types and organizations of specialized farm enterprises and to compare their profitability. All the major types of enterprises in the three provinces have been included, although not all combinations of enterprises have been considered.

The author cautions that he encountered inadequacies of data with respect to at least some aspects of all enterprises analysed. Undoubtedly, further research is needed to improve the quality of data and to refine analytical techniques. Yet the Board believes that this enterprise analysis provides a most useful and hard-headed approach to some of the most vexing problems of agricultural production in the Maritimes.

The enterprise analyses were based on current data (1966-67) and for this reason should not be interpreted as a forecast of future results. This is so because the conditions and relationships under which particular enterprises operate may be expected to be altered by future changes in technology, markets or other such characteristics, and these changes are likely to change the potential profitability of the enterprises. Nevertheless, the budget analysis provides a valuable indication of the probable potential of such enterprises and, used discriminately with other necessary information, should be a useful guide.

This study was possible only because a great many farmers, officials and others, both in the Maritimes and in other provinces, gave generous assistance. Their contributions are more specifically acknowledged in the main report.

CONTENTS

TABLES

MARITIME FARM ENTERPRISE ANALYSIS

1. INTRODUCTION

Nature of the Analysis

The objective of this enterprise analysis has been to compare the relative profitability of the most significant farming enterprises of the three Maritime provinces as a guide to future development of the industry. Such a comparison, of course, is a complex and demanding task under the best conditions. It is more difficult when data inadequacies and other deficiencies handicap the analysis. To examine the comparative profitability of such enterprises most effectively, it is usually necessary to simplify the procedures of analysis and thereby reduce the number of variables. In this analysis, the procedure was simplified by specifying that each enterprise was a specialized, single-product operation and by other techniques.

An enterprise analysis of this kind must have as its basis a sound knowledge of critical comparative information on such matters as the physical resources available; economic and institutional considerations; the effects of recent changes in technology; the present structure and trends in Maritime farming; the supply of capital, technology and labour; marketing, prices, and market potentials; and the overall potential of these for agriculture. These parts of the study have been examined in The Competitive Position of Maritime Agriculture.

This foundation of comparative information on the farming industry can be brought to focus in the comparative analysis of input-output relationships within each enterprise by using the budget method of analysis. Starting from initial enterprises that represent approximately the existing pattern of physical resource use as well as the institutional and other influences, as reflected in established inputs, outputs, prices and incomes, a comparison of the various types of enterprises may be carried out utilizing budget analysis. After this initial comparison, the next step is to use the budget method to examine the net results from combining resources in alternative and more efficient ways as a means of increasing the profitability of the enterprise.

All of the major enterprise types in the three Maritime provinces were included in this study. These analyses examined the present status of the various enterprise types and made an assessment of their profitability. Their comparative advantage was measured in terms of their ability to produce satisfactory levels of income and to satisfy specified labour and social objectives. Such comparisons were made among enterprises within and among provinces, and between the Maritime region and competing regions. The scope for expanding those enterprises that appeared to have the greatest comparative advantage was examined in terms of land availability, markets, labour supply and competing resource demands.

Each of the enterprises analysed was, in the main, examined as a specialized single-enterprise farm. This approach should not be interpreted as implying that supplementary and complementary enterprises may not add substantially to income under particular enterprise conditions. In fact, some enterprises are more likely to be most profitable as supplementary or complementary enterprises under some circumstances. In general, however, under conditions of modern technology, specialization may be expected to achieve greater efficiency and profitability than diversification. This specialized enterprise approach also simplifies the analytical procedures and avoids the difficulties associated with allocating overhead costs and labour among enterprises.

Selection of Enterprises

Two main criteria were used in selecting enterprises for analysis in this study. The enterprises selected included those which were currently important in Maritime agriculture and those which appeared to have some growth potential beyond their existing level. The number of enterprises considered in each province was somewhat less than the total number of enterprises for all provinces since some are not important in all three provinces. The enterprises considered in the analysis included the following: dairy, beef, hogs, poultry, potatoes, tree fruits, strawberries, blueberries, feed grains, forages, processing vegetables and greenhouses.

The dairy enterprise was included in the analysis because of its current importance in Maritime agriculture. It has also been the main land-using enterprise in the Maritimes for many years; hence the future pattern of land-based agriculture depends, to a considerable degree, on whether the profitability of the dairy enterprise can be maintained. Beef production in the Maritimes is largely a byproduct of the dairy industry. There has been, however, some interest in more specialized beef enterprises, and it is this aspect that has been appraised in this analysis. Hog and poultry production based largely on imported grains has expanded in recent years, and these enterprises now account for a very significant pro-

portion of the total agricultural output of the Maritime provinces.

Potato and tree fruits enterprises are two of the main sources of farm income in the Maritimes - potatoes in Prince Edward Island and New Brunswick and apples in Nova Scotia - and are the sources of the region's major agricultural exports. The future profitability of these enterprises in this region is dependent on their ability to compete with other regions. Small-fruit enterprises, mainly blueberries and strawberries, have been based, to a degree, on the physical suitability of these crops to Maritime conditions and on the availability of relatively cheap supplies of harvest labour. The comparative advantage of these enterprises was examined on the basis of production for export under conditions of increasing cost and unavailability of seasonal labour supplies.

Feed grains have been produced in the Maritimes largely as a byproduct of potato enterprises and as a companion crop in seeding down forages. In this analysis the potential of specialized grain enterprises was examined. The profitability of beef and dairy enterprises is, to a very significant degree, dependent on the ability of the land to produce low-cost forage crops. In this analysis a comparison of the inputs required, to produce forages in the Maritimes and in other regions elsewhere indicated the relative profitability of beef and dairy enterprises in each region.

Enterprises producing processing vegetables (peas, beans and cole crops) in the Maritimes were examined mainly on the basis of data from vegetable processors. Greenhouse production (mostly tomatoes) was examined on the basis of data from Nova Scotia, Ontario and the northeastern United States.

The analysis of each enterprise was carried out in two main stages. The first or initial stage was based on an enterprise representative of existing enterprises. This initial-stage enterprise was then expanded into a second or "optimum scale" enterprise in which the scale was determined largely by the objectives, specified as suitable, for income, labour and social amenities for the farm family. The expansion of enterprises assumed that managerial skills would improve and levels of productivity and efficiency would rise where warranted.

The initial-stage enterprises were designed to represent an existing scale of farms, and census or other data was used in setting up budgets for them. But although they were mainly structured on the basis of these data, they were qualified by certain selection criteria. One of these selection criteria was that the initial-stage enterprises should provide a suitable and feasible basis from which experienced farmers could expect to move, without unreasonable difficulty, toward an optimum scale of enterprise. In general, this

"suitable and feasible" condition necessitated using above-average-scale enterprises for the initial-stage analysis. The suitable and feasible criterion does not imply that the initial-stage enterprises were economic units providing both a satisfactory return on capital and an adequate labour income.

The second stage in the budget analyses of enterprises was concerned with the appraisal of expanded or "optimum" scale enterprises. These optimum-scale enterprises were designed to fulfill three main objectives to ensure that they provided satisfactory economic and social units. These objectives were: (1) that the labour inputs of farm operators be comparable to those of workers in non-farm occupations, (2) that the operator's labour income be comparable to that obtainable in other occupations requiring similar levels of managerial and technical competence and (3) that the operator and his family have reasonably comparable access to normal social amenities. If physical and economic conditions in the Maritimes prevented a particular enterprise from achieving these objectives, that enterprise was considered unlikely to survive in the competition for higher incomes. Enterprises likely to fulfill the above objectives were considered in terms of their growth potential as determined by the availability and suitability of lands, markets, labour requirements, resource requirements of other enterprises, etc. The more important financing and farm planning considerations involved in expanding initial-stage enterprises to the scale necessary to achieve the stated objectives were also considered.

Selection of Locations

For the budget analyses, specific locations were selected for initial application of the various enterprises. In general these locations corresponded to the areas where the particular enterprises are most concentrated in the respective provinces. For example, the budget analysis of Nova Scotia dairy enterprises assumed a location in the Truro area. The Grand Falls area in New Brunswick and the Summerside area in Prince Edward Island were selected as locations for potato enterprises. The locations selected could be described as generally the "best" locations for the various enterprises in the respective provinces. In most cases the precise data necessary to make economic distinctions among locations within and between provinces in terms of physical productivity, land availability, land suitability and other factors were not available. Yet, where economic factors (transportation costs, input prices, etc.) do not indicate where a particular enterprise is likely to be the most profitable, physical factors (climate, topography, soil type, area of suitable land, etc.) frequently indicate the scope for this enterprise.

Analysis Technique

The technique used for appraising the comparative advantage of Maritime enterprises was the budget analysis. Budgeting is a quantitative tool used in business or farm planning to compare the effects on net income of probable increases or decreases in costs and revenues that would result from alternative changes in inputs. A budget is simply a convenient tool to facilitate a quantitative appraisal of all of the physical and economic considerations bearing on a particular enterprise or farm. If these considerations are specified in sufficient detail a budget can show the effect of a change in the combination of resources or inputs on the income position of the enterprise and provide a basis for considering adjustments to the farm plan or organization which produced that outcome. Budgeting, therefore, provides a means by which expansion alternatives for a particular initial-stage enterprise can be tested and weaknesses identified. The budget approach to enterprise analysis requires the use of reliable input-output data. The reliability and usefulness of the budgeted results depend on the accuracy of the input and output data used, and such data must be developed by advanced physical and economic research on the basis of practical farm operations. In the past there has been too little of this type of research in the Maritimes.

Budget analysis was used in this study to give an objective, quantitative appraisal of Maritime agricultural enterprises in terms of their ability to produce satisfactory levels of income. Through budget analysis it was possible to show the scale that enterprises would have to reach under various price and productivity assumptions in order to attain particular levels of labour income. In some cases, the budget analysis indicated that such income levels could not be reached under the physical and economic conditions prevailing in the region. Through budget analysis it was possible to determine which enterprises were the most profitable and which enterprises have the greatest comparative advantage. It was also possible to compare these enterprises with similar enterprises in competing regions and thereby indicate their probable potential for expansion.

Sources of Information and Data Requirements

The budgets which were developed for the various enterprises reflect estimates of input levels, productivity, prices, etc., obtained from a great number of sources. These included the 1961 and 1966 censuses; enterprise studies conducted in Nova Scotia; publications of the Canada Department of Agriculture, provincial departments of agriculture, Dominion Bureau of Statistics, and Agricultural Experiment Stations in the United States; farm management manuals; primary data collected from farmers, research and extension personnel,

credit advisors and Maritime agri-businessmen and other sources. Recourse to information from areas outside the study area was often necessary because of the severe shortage of pertinent information in the Maritimes for this type of analysis.

In general, the price estimates used for products reflect average prices over a recent series of years and, where possible, reflect historical differences between provinces and regions. The prices used for inputs reflect current prices in the individual provinces. In general, the differences in net incomes for particular enterprises among provinces were due to differences in input and product prices. In most cases it was not possible to differentiate among provinces and areas on the basis of differences in productivity, e.g., productivity of land. There were two main reasons for this; first, data were not available to distinguish inter-area and interprovincial differences in productivity, and second, the budgets for the various enterprises represent the areas where these enterprises are currently concentrated in the respective provinces. Productivity differences among these "best" areas tend to be slight. One of the greatest needs, in an appraisal such as this, is for data which indicate the extent and location of these "best" areas within the various provinces. This point has particular relevance for enterprises such as beef, dairy and grain which require relatively large amounts of land. Current data on land quality do not provide an adequate basis on which to project the scope of these enterprises in the Maritimes generally or in any particular area or province within it.

For a satisfactory appraisal, particularly of land-based enterprises, data which reflect differences in physical productivity among areas, provinces and regions are required. Data for this purpose were not available. Some of the kinds of data needed for such analyses are listed below. In many cases these requirements are not specific to the Maritimes although, in general, the data inadequacies are more severe there than in other regions. Such data requirements would include the following:

1. Estimates of the land area in each province physically suited to the production of field crops, particularly forages and grain. A mapping study conducted as a supplement to this study indicated that Canada Land Inventory data would not provide these data in sufficient detail.

2. Comparable measures of the particular inputs required to obtain alternative levels of output under practical farm conditions in the various areas and regions. Research data currently

available are generally not satisfactory for this purpose.

3. Measures of inter-area differences in the probability of achieving particular levels of output from given inputs. This has implications for inter-area differences in risks associated with crop and livestock production.

4. Measures of the inter-area and interregional differences in the effects of climate (amount and frequency of rainfall, relative humidity, hours of sunshine, seasonal temperatures, etc.) on such things as:

   (a) Machine capacity.

   (b) Machinery requirements, e.g., the high incidence of plowing in eastern Canada as compared to western Canada and the effects this has on machine costs, labour productivity, etc.

   (c) Efficiency of livestock feeding.

   (d) Housing requirements for livestock.

   (e) Risk in crop production.

   (f) Rate and seasonal distribution of plant growth.

   (g) Maturity and harvesting of crops, e.g., the effect of differences in rainfall frequency, humidity, temperature, and other factors on the ability to harvest grain and forage crops.

2. CRITERIA FOR OPTIMUM-SCALE ENTERPRISES

The objectives of optimum-scale enterprises were established in terms of three criteria: (1) that levels of income (labour income) be comparable to those achieved in non-farm occupations, (2) that labour inputs be comparable to those in other occupations and (3) that there be access to normal social amenities.

Incomes in agriculture in Canada are much lower than in most non-farm occupations. A recent study by the Economic Council of Canada indicated that the average income per worker in agriculture in Canada in the 1960-64 period was roughly half of that received by non-agricultural workers (Table 2-1). In the Maritimes, where incomes in both agriculture and non-agriculture are lower than in other regions, the average income in agriculture was only about one-third of that received by workers in non-agriculture. In other words, the level of income in agriculture is lower and the disparity in income between agriculture and non-agriculture is greater in the Maritimes than elsewhere. The average income per worker in agriculture in the 1960-64 period was about $1,100 in the Maritimes, $2,500 in Ontario and western Canada and $1,900 in Canada as a whole. This compared with average incomes of about $3,300 per worker in non-agriculture in the Maritimes, $4,200 in Ontario, $4,000 in western Canada and $3,800 in Canada as a whole. By regions the ratios of non-agricultural to agricultural income per worker were approximately as follows: Maritimes - 3.1, Québec - 2.5, Ontario - 1.7, Prairies - 1.6, and British Columbia - 1.5. Incomes in agriculture in the Maritimes in this period were from one-half to one-third as high as incomes in agriculture elsewhere in Canada and about one-fourth as high as incomes in non-agriculture in Ontario and western Canada.

The study referred to above also provided some data on the regional trends in the ratios of income per worker in non-agriculture and agriculture (Table 2-2). These data suggest that the disparities in income between agriculture and non-agriculture narrowed in all regions except Québec and the Maritimes in the period from 1947 to 1963. Data for the 1961-65 period, however, suggest a narrowing of this disparity in the Maritimes as well (Table 2-3). These more recent data indicate a very rapid rate of growth in income per worker in agriculture in the Atlantic region in this period. This rate was due to both substantial increases in total agricultural income (8.3 per cent per year) and large decreases in employment in agriculture (9.6 per cent per year).

If the income gap between agriculture and non-agriculture is to be narrowed to the point where farm families enjoy incomes comparable to those of their urban neighbours, farms and farm enterprises need to be expanded to a

TABLE 2-1

Differences in Income Per Worker Between Agricultural and Non-Agricultural Activity by Provinces, 1960-64 Average

	Income Per Worker		Ratio of Non-Agriculture to Agriculture
	Agriculture	Non-Agriculture	
	$	$	
P.E.I.	1,100	3,333	3.0
N.S.	937	3,495	3.7
N.B.	1,000	3,150	3.2
Qué.	1,481	3,645	2.5
Ont.	2,536	4,242	1.7
Man.	1,984	4,015	2.0
Sask.	3,008	4,091	1.4
Alta.	2,698	4,078	1.5
B.C.	3,080	4,537	1.5
Average	1,882	3,811	2.0

Source: Chernick, S.E. Interregional Disparities in Income, Staff Study No. 14, Economic Council of Canada, Ottawa, 1966, p. 31.

TABLE 2-2

Percentage Ratio of Income Per Worker in Non-Agriculture to Income Per Worker in Agriculture in Canada, by Regions, 1947 and 1963

	1947*	1963*
	%	%
Maritimes	247	307
Québec	249	255
Ontario	199	165
Prairies	137	130
British Columbia	128	121

* Ratios are based on three-year averages centred on 1947 and 1963.

Source: Chernick, *op. cit.*

TABLE 2-3

Average Annual Percentage Increase in Income Per Worker in Agriculture and Non-Agriculture in Canada, by Regions, 1961-65

Region	Agriculture	Non-Agriculture
	%	%
Atlantic	20.0	3.1
Québec	2.2	4.0
Ontario	5.5	4.4
Prairies	15.4	2.7
British Columbia	8.1	3.7
Canada	10.1	3.8

Source: Prices, Productivity and Employment, Third Annual Review, Economic Council of Canada, Ottawa, 1966.

scale which will generate this level of income. Various measures of income were considered in establishing the income objective of optimum-scale enterprises. These included personal income per capita, average family income, income per worker and others. Since the analysis of enterprises assigned no value to operator and family labour (the return to operator and family labour was a residual) it was felt that the income objective of these enterprises could be expressed most appropriately in terms of family income.

Recent studies by the Dominion Bureau of Statistics provide some measures of the average incomes of non-farm families in Canada. These data along with some indications of the rates of increase (Table 2-4) in these incomes provided a basis on which to establish an income objective for agricultural enterprises in the Maritimes. The average income of non-farm families in Canada in 1963 was $5,939. The range, by regions, was from $4,375 per family in the Atlantic region to $6,571 per family in Ontario. Both the level of income and the rate of increase in income are substantially below average in the Maritimes. Between 1961 and 1963 average family incomes in Ontario and the Prairies increased by 14 and 13 per cent, respectively, while the increase in the Atlantic region was only 5 per cent. Preliminary indications from 1965 family income data suggest an average increase of 8 to 10 per cent over 1963 levels for Canada as a whole. With a 10-per-cent increase this would put the average income of non-farm families in Canada in 1965 at about $6,500.

TABLE 2-4

Incomes of Non-Farm Families in Canada, by Region, 1961 and 1963

Region	1961	1963
	$	$
Atlantic	4,156	4,375
Québec	5,294	5,899
Ontario	5,773	6,571
Prairies	4,836	5,478
British Columbia	5,491	5,917
Canada	5,317	5,939

Source: Incomes, Assets and Indebtedness of Non-Farm Families in Canada, 1963, No. 13-525, D.B.S., Ottawa, 1966; Distribution of Non-Farm Incomes in Canada by Size, 1961, No. 13-521, D.B.S., Ottawa.

If the disparity between incomes in the Maritimes and the rest of Canada is to be overcome, it seems that income objectives of optimum-scale agricultural enterprises should be set higher than the average incomes received in that region. The income objective for these enterprises should, therefore, aim at the average family income in the higher income areas or in Canada as a whole. This suggests an income objective of something in excess of $6,000 per family for optimum-scale enterprises. This level of income was used in appraising the potential of optimum-scale enterprises to provide satisfactory incomes for Maritime farmers.

The labour and social objectives of optimum-scale enterprises assure that labour inputs in particular enterprises are not excessive relative to non-farm employment and not of a nature which limits access to normal social amenities. In some enterprises a satisfactory level of income assures access to social amenities. In others, particularly livestock enterprises, the nature of the labour requirements often restricts access to social amenities unless the enterprise is large enough to employ two or more men, and mechanized enough so that the essential tasks can be performed by less than the whole labour force attached to that enterprise. The dairy enterprise probably best illustrates the problem. The amount of labour required daily for the operation of a dairy herd can be varied only slightly by omitting a few less essential tasks. These labour requirements are very time-specific and in one-man enterprises virtually prevent participation in many social activities. A dairy farm in order to provide for regular days

off, holidays, staggered working hours and the like should be large enough to provide employment for three or more men. In cash-crop enterprises, such as tree fruits and potato enterprises, satisfactory units in terms of these social and labour objectives can often be established with one-man enterprises.

3. DESCRIPTION OF EXISTING ENTERPRISES

Maritime agriculture is characterized by a few large-scale farms and many very small-scale farms. The evidence of very small-scale enterprises is provided by the small acreage per farm, low levels of capital inputs, a relative lack of specialization and low levels of income. The larger scale farms are illustrated by the potato enterprises of New Brunswick and poultry enterprises in Nova Scotia.

The average sizes of enterprises, capital inputs and gross sales on all farms and on commercial farms in the Maritimes in 1961 are presented in Tables 3-1 and 3-2. In some cases the data do not describe the actual situation very well because of the inclusion, in the averages, of large numbers of non-commercial enterprises. This is true, for example, of poultry and potato enterprises, where relatively small numbers of enterprises account for most of the output. Also in some enterprises there have been significant shifts in the average size since 1961 due to increases in the size and number of larger enterprises and decreases in the number of small enterprises. The relatively small size of farms generally is indicated by the average size of dairy enterprises, the average cropland acreage and the average capital value of farms. In 1961 the average dairy enterprise in the Maritimes had only six to seven cows. Even on commercial farms dairy enterprises had less than a dozen cows. Cropland acreage exceeded 50 acres per farm only in Prince Edward Island in 1961 and was less than 70 acres per farm on commercial farms in all three provinces. The average capital value was about $12,000 per farm in 1961 and,for commercial farms, about 50 per cent greater. Gross sales of commercial farms ranged from about $4,500 per farm in Prince Edward Island to about $6,400 per farm in Nova Scotia.

An indication of the degree to which these figures underestimate the average sizes of enterprise is given in Table 3-3. The figures in this table indicate the percentage of the various enterprises reported by commercial farms in 1961 which also reported sales of products from those enterprises. Some significant differences among products and provinces are evident from the data. The proportion of commercial farms with dairy cows which reported sales of dairy products was relatively high in all provinces. Similarly with farms which reported cattle and hogs. A much lower proportion of the farms with poultry reported sales of poultry products. Significant differences among provinces in the proportion of enterprises which reported sales were apparent for potato, vegetable and tree fruits enterprises. For example, almost all commercial farms which reported an acreage of potatoes in Prince Edward Island in 1961 also reported sales of potatoes as compared to about one-third of the enterprises in Nova Scotia and one-half in New Brunswick.

TABLE 3-1

Characteristics of Farms in the Maritimes in Terms of Average Sizes of Enterprises and Average Capital Value, 1961

Enterprise or Item	Unit	Prince Edward Island	Nova Scotia	New Brunswick
Livestock				
Dairy	cow	6.4	6.7	7.3
Cattle (incl. dairy)	head	18.5	15.5	16.1
Hogs	hog	14.0	12.0	9.0
Poultry	chicken	120.0	370.0	150.0
Crops				
Potatoes	acre	8.1	1.0	6.6
Tree Fruits	"	-	9.6	4.5
Tame Hay	"	27.1	23.5	29.4
Grain	"	30.5	10.3	16.1
Cropland	"	53.3	26.3	40.9
Strawberries	"	2.0	0.8	0.8
Blueberries	"	70.8	19.6	34.4
Vegetables	"	2.7	3.2	5.3
Greenhouses	sq. ft.	2,627	9,362	6,880
Capital				
Land and Buildings	$	7,158	7,131	7,646
Machinery	$	3,661	2,417	2,688
Livestock	$	2,309	2,083	2,000
Total	$	13,128	11,631	12,334

Source: Census of Canada, Agriculture, 1961.

Some improvement in the average sizes of enterprises has occurred since 1961. This is indicated by comparing 1966 data (Table 3-4) with 1961 data (Table 3-1). The average size of dairy enterprise increased 25 to 30 per cent in this period. The average size of hog enterprise doubled in Prince Edward Island and Nova Scotia and poultry enterprises more than doubled in average size in Nova Scotia and New Brunswick. Hay acreage per farm increased significantly (20 to 30 per cent) as did average potato acreage. The average enterprises in 1966 were, however, still very small when viewed in terms of the sizes of enterprises required for efficient, economic units.

TABLE 3-2

Characteristics of Commercial Farms in the Maritimes in Terms of Average Sizes of Enterprises, Capital Value and Gross Sales, 1961

Enterprise or Item	Unit	Prince Edward Island	Nova Scotia	New Brunswick
Livestock				
Dairy	cow	8.0	11.2	11.3
Cattle (incl. dairy)	head	24.0	26.0	25.0
Hogs	hog	17.0	21.0	14.0
Poultry	chicken	162.0	807.0	279.0
Crops				
Potatoes	acre	10.3	1.6	12.5
Tree Fruits	"	-	13.1	6.2
Tame Hay	"	31.4	33.7	39.4
Grain	"	37.0	13.7	21.5
Cropland	"	67.9	43.0	63.0
Capital				
Land and Buildings	$	8,730	10,761	10,654
Machinery	$	4,914	4,098	4,358
Livestock	$	3,128	3,829	3,268
Total	$	16,772	18,688	18,280
Value of				
Products Sold	$	4,577	6,385	5,647

Source: Census of Canada, Agriculture, 1961.

TABLE 3-3

Percentage of Commercial Farms in the Maritimes which Reported Sales of Reported Items

1961

	Prince Edward Island	Nova Scotia	New Brunswick
	%	%	%
Dairy Cows*	87	81	85
Cattle	92	90	89
Hogs	99	87	90
Poultry - eggs	57	51	48
- meat	28	33	23
Potatoes	97	34	55
Vegetables	54	82	79

* Figures indicate the percentage of commercial farms with dairy cows which reported sales of dairy products.

Source: Census of Canada, Agriculture, 1961.

The relatively small size of farms in the Maritimes is further indicated by data which show the proportion of farms in the upper sales and capital categories (Table 3-5). In 1961 less than 5 per cent of all farms in the Maritimes sold agricultural products valued at more than $10,000. Less than 10 per cent of all farms had a total capital value in excess of $25,000 and less than 0.5 per cent had in excess of $100,000 in capital. In New Brunswick and Prince Edward Island potato farms accounted for a large proportion of the farms in the upper sales and capital categories. In Nova Scotia poultry and dairy farms were the main farms in these categories. In 1966 the proportion of farms in the $10,000-plus gross sales category was substantially higher than in 1961; about three times as high in Prince Edward Island and about double in Nova Scotia and New Brunswick. A substantial portion of the increase in the percentage of farms in this category, especially in Nova Scotia and New Brunswick, however, was due to the reduction in the total number of farms rather than to an absolute increase in the number of farms in the category. The total number of farms in the $10,000-plus category increased

TABLE 3-4

Average Sizes of Selected Enterprises in the Maritimes, 1966

Enterprise or Crop	Unit	Prince Edward Island	Nova Scotia	New Brunswick
Dairy	cow	8.0	8.6	9.3
Cattle (incl. dairy)	head	23.2	19.0	20.1
Hogs	hog	29.4	27.0	11.8
Poultry	chicken	136.4	861.0	352.5
Potatoes	acre	11.5	1.0	11.9
Tame Hay	acre	32.2	30.7	35.9

Source: Census of Canada, Agriculture, 1966.

about 250 per cent in Prince Edward Island and about 50 per cent in both Nova Scotia and New Brunswick between 1961 and 1966.

The proportion of farms in the upper gross-sales categories is substantially higher in other parts of Canada than in the Maritimes. In Ontario, Saskatchewan and Alberta 26.7 per cent, 29.2 per cent and 25.9 per cent, respectively, of all farms reported product sales in excess of $10,000 in 1966 - percentages 2.5 to 3.0 times the size of those in the Maritimes. Furthermore, the ratio of net income to gross income tends to be substantially higher in these areas than in the Maritimes; this suggests that in a distribution of farms by net incomes the Maritime provinces would be worse off relative to Ontario and western Canada than gross sales data would suggest.1/

1/ In the 1961 to 1964 period the ratios of net income to gross income averaged about 25 per cent in the Maritimes, 33 per cent in Ontario, 48 per cent in Saskatchewan and Alberta and 41 per cent in Canada as a whole.

TABLE 3-5

Percentage of Farms in the Maritimes in the Upper Capital and Gross Sales Categories, 1961 and 1966

	1961			1966		
	P.E.I.	N.S.	N.B.	P.E.I.	N.S.	N.B.
			per cent			
Gross Sales						
$10,000 and over	4.3	5.0	5.1	12.3	9.5	10.7
15,000 and over	1.8	2.8	2.7	6.2	5.3	6.9
25,000 and over	0.7	1.3	1.1	2.7	2.6	3.3
35,000 and over	n.a.	n.a.	n.a.	1.5	1.6	1.9
Total Capital						
$24,950 and over	9.1	8.6	9.5	n.a.	n.a.	n.a.
49,950 and over	0.9	1.6	1.7	n.a.	n.a.	n.a.
99,950 and over	0.1	0.3	0.4	n.a.	n.a.	n.a.

Source: Census of Canada, Agriculture, 1961 and 1966.

4. DAIRY ENTERPRISE

One criterion used in selecting enterprises for analysis was the current importance of the particular enterprise in one or more of the Maritime provinces. The dairy enterprise is one of the major enterprises in Maritime agriculture and warranted inclusion in the analysis on this basis. The dairy enterprise is important in all three provinces but especially so in Nova Scotia where it is the main source of farm income. Milk production for the fluid market is particularly important in Nova Scotia and New Brunswick where 57 per cent and 48 per cent of total milk production is sold as fluid milk. In Prince Edward Island, on the other hand, less than 10 per cent of total milk production (9.6 per cent in 1966) is sold on the fluid market.

The analysis of dairy enterprises was based on an enterprise producing manufacturing milk. The principal reasons for selecting the manufacturing milk enterprise were twofold. First, efficient manufacturing milk enterprises can be considered, from the viewpoint of management, organization and operation, as essentially similar to fluid milk enterprises. The main difference revolves around the price received for their products. Second, fluid milk production in the Maritimes is limited to the Maritime market. This market is not expanding, in fact the total volume of fluid sales declined slightly in the last 10 years despite a substantial increase in population. Therefore, expansion in milk production beyond the fluid milk requirements must be in manufacturing milk production where Maritime producers must compete with producers in other areas; hence the selection of the manufacturing milk enterprise.

In the Introduction it was pointed out that, in general, enterprises of above-average scale were selected for the initial-stage enterprise analysis. This was necessary in order to satisfy the suitable and feasible basis criterion established for these enterprises. The budgets for initial-stage dairy enterprises were based on 25-cow enterprises in Nova Scotia and New Brunswick and a 20-cow enterprise in Prince Edward Island. These sizes of enterprises corresponded roughly to the average of the upper 10 per cent of all dairy enterprises in the respective provinces in 1961. The budget for the initial-stage enterprise attempted to incorporate existing levels of productivity, capital, costs, managerial ability, etc., while the budget for the "optimum" scale enterprise assumed improved levels of productivity, efficiency, etc.

The optimum-scale enterprise was developed in terms of the income, labour and social objectives of these larger enterprises. The nature of the labour requirements of a dairy enterprise make it difficult to achieve the labour and social objectives unless the enterprise is large enough to employ at

least three men. In order to achieve these objectives the enterprise must be organized in a manner which provides for regular days off, holidays and the like. To accomplish this the enterprise would need to be mechanized to the point where two men can perform the essential tasks, i.e., milking and feeding, in the absence of the third.

Background Information

The production of milk and dairy products has always been an important segment of agricultural activity in the Maritime provinces. Sales of dairy products account for roughly one-quarter of farm cash receipts. If sales of cull cows and surplus dairy calves are added to dairy receipts, the proportion is close to one-third of farm cash receipts. The proportion of farm receipts derived from dairy production varies substantially among provinces. In the 1961-65 period, for example, farm cash receipts from the sale of dairy products accounted for about 19 per cent of the total in Prince Edward Island, 26 per cent in Nova Scotia and 25 per cent in New Brunswick. The importance of dairying in Maritime agriculture is also reflected in the proportion of commercial farms which are classified as dairy farms, i.e., farms receiving over half of their gross income from a dairy enterprise. According to the 1966 census, about 29 per cent of the commercial farms in the Maritimes were dairy farms. Dairying was the major source of income on many livestock combination farms as well. By way of comparison, 64 per cent of the commercial farms in Québec and 30 per cent in Ontario were classified as dairy farms in 1966.

Within the Maritime provinces the relative importance of dairying varies considerably by areas, especially in Nova Scotia and New Brunswick. Dairying is concentrated in one or two relatively small areas in each province: the Annapolis Valley and the Stewiacke area in Nova Scotia, the Fredericton and Sussex-Moncton areas in New Brunswick and Queens County in Prince Edward Island.

Trends in cow numbers and milk production in the Maritimes have been generally downward in recent years. Dairy cow numbers have been declining in all three provinces for more than 25 years (Table 4-1). Between 1941 and 1967 the dairy cow population in the Maritimes declined about 50 per cent; 22 per cent in Prince Edward Island, 54 per cent in Nova Scotia and 58 per cent in New Brunswick. Milk cows as a proportion of the total cattle population declined from 53 per cent to 34 per cent over the same period. Milk production has also been declining in the Maritimes but, due to increased milk output per cow, the decline has been at a slower rate than the decline in cow numbers. Over the period from 1956 to 1966 total milk output was fairly constant in Prince Edward Island and declined about 20 per cent in Nova Scotia, 28 per

TABLE 4-1

Number of Milk Cows in the Maritimes

Selected Years, 1941-67*

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	---------------- thousands	------------------------		
1941	46	108	115	269
1951	44	98	102	244
1956	47	89	98	234
1961	40	64	67	171
1962	38	62	64	164
1963	37	60	59	156
1964	37	59	58	154
1965	39	57	56	152
1966	37	52	52	141
1967	36	50	48	134

* Quarterly Bulletin of Agricultural Statistics, 21-003, D.B.S., Ottawa. The data refer to cows and heifers, two years old and over, for milk.

cent in New Brunswick and 19 per cent in the three provinces combined.

Milk utilization in the Maritimes has undergone significant changes in recent years mainly in response to changes in total milk output (Table 4-2). In the 1956-66 period the proportion of total milk production used for fluid sales in the Maritimes increased from 32 per cent to 42 per cent. The increase reflects the decline in total milk output,not an increase in fluid milk requirements. The actual volume of fluid sales changed very little in this period. The differences among provinces in the utilization of milk are significant. In Prince Edward Island less than 10 per cent of the total milk output is sold as fluid, compared to Nova Scotia and New Brunswick where 57 per cent and 48 per cent is sold as fluid. Obversely, about 78 per cent of Prince Edward Island milk is used in manufactured milk products as compared to 32 per cent

in Nova Scotia and 42 per cent in New Brunswick. Most of the manufacturing milk is utilized in butter production; 76 per cent in Prince Edward Island, 65 per cent in Nova Scotia, and 86 per cent in New Brunswick.

TABLE 4-2

Milk Production and Utilization in the Maritime Provinces, Selected Years, 1956-66

Province	Year	Total Production	Utilization: Fluid Sales	Utilization: Used In Factories	Utilization: Used on Farms
		million lbs.	%	%	%
P.E.I.	1956	229	11.6	69.5	18.9
	1961	227	11.4	71.7	16.9
	1966	225	9.6	78.2	12.2
N.S.	1956	431	42.3	39.3	18.4
	1961	384	48.9	33.1	18.0
	1966	346	57.4	32.2	10.4
N.B.	1956	460	32.1	48.4	19.5
	1961	408	36.1	45.1	18.8
	1966	332	47.8	41.8	10.4
Maritimes	1956	1,120	31.8	49.2	19.0
	1961	1,020	36.8	49.2	14.0
	1966	903	42.0	47.2	10.8

Source: Quarterly Bulletin of Agricultural Statistics, 21-003, D.B.S., Ottawa.

The Maritime region as a whole is a milk-deficit area. Prince Edward Island produces more than it requires but the surplus is not large enough to offset deficits in the other two provinces. A 1964 study estimated Maritime production at about two-thirds of total milk requirements.1/ Production was estimated at 46 per cent, 63 per cent and 236 per cent of requirements in Nova Scotia, New Brunswick and Prince Edward Island, respectively. A study in Nova Scotia in 1962 estimated that province's milk production at 55 per cent of requirements.2/ Each province produces virtually all its own fluid milk requirements, hence the deficits occur in supplies of milk

1/ Economics Branch, Canada Dept. of Agriculture, Truro, Nova Scotia, 1966.

2/ Larsen, H.K., Demand and Production Analysis of Agricultural Products in Nova Scotia (1950-72), Voluntary Economic Planning, 1964.

for manufactured products. The total milk deficit in the Maritimes has been estimated at 400 to 450 million pounds. To satisfy this requirement within the region would require a 50-per-cent increase in total milk production. In order to capture this market, however, Maritime dairy enterprises must be competitive with dairy enterprises in other areas.

Dairy enterprises in the Maritimes are, on the average, very small (Table 4-3). In 1966 the average dairy enterprise in the Maritimes reported 8.6 cows; 8.0 in Prince Edward Island, 8.6 in Nova Scotia, and 9.3 in New Brunswick. The distribution of enterprises by number of cows indicates a substantial concentration of enterprises in the smaller size categories; in 1961 only about 14 per cent of the dairy enterprises in the Maritimes reported more than a dozen cows (Table 4-4). These data include a substantial number of small non-commercial enterprises, hence they underestimate the average size of commercial enterprises. However, data for fluid milk enterprises in Nova Scotia also indicates a fair concentration in the smaller size categories, though substantially less than in the census data (Table 4-5). In 1966 two-thirds of the fluid milk herds in Nova Scotia had less than 20 cows, and 10 per cent had more than 30 cows. The size distribution of fluid milk herds in New Brunswick is roughly similar to that in Nova Scotia. Data on the size distribution of milk quotas in New Brunswick in 1966 indicates that about 70 per cent of the fluid milk producers have weekly quotas of less than 3,000 pounds and only about seven per cent are larger than 5,000 pounds per week.1/

TABLE 4-3

Average Number of Milk Cows in Dairy

Enterprises in the Maritimes, 1951, 1961 and 1966

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
1951	4.4	4.1	4.2	4.2
1961	6.4	6.7	7.3	6.8
1966	8.0	8.6	9.3	8.6

Source: Census of Canada, Agriculture, 1961.

1/ Based on information from the 1966 annual report of the Dept. of Agriculture in New Brunswick. A 5,000 pound quota is equivalent to about 250,000 pounds per year or the output of about 25 good cows. Since, in most enterprises, not all of the milk produced is sold as fluid a 5,000 pound quota would represent more than a 25-cow enterprise.

TABLE 4-4

Size Distribution of Dairy Enterprises

in the Maritimes, 1961

Number of Cows	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	per cent			
1 - 7	67.6	71.5	67.3	69.0
8 - 12	23.4	13.2	17.0	17.1
13 - 17	6.2	6.7	7.3	6.8
18 and Over	2.8	8.6	8.4	7.1

Source: Census of Canada, Agriculture, 1961.

TABLE 4-5

Size Distribution of Fluid Milk Herds

in Nova Scotia, 1966

Number of Cows	Per Cent of Herds	Average Per Herd
	%	no.
1 - 10	22	8.0
11 - 20	44	15.8
21 - 30	23	25.6
31 - 40	6	35.2
41 - 50	2	45.9
50 and Over	2	61.6

Source: Report of Nova Scotia Milk Industry Inquiry Committee 1966-67.

Budget Analysis of an Initial-Stage Enterprise

The budget analysis of the initial-stage dairy enterprises was based on a manufacturing milk enterprise. If manufacturing milk production is profitable, then it can be presumed that fluid milk yielding a higher price will also be profitable. Moreover the adjustments pertinent to manufacturing milk enterprises apply with equal effect to fluid milk enterprises. In selecting the initial-stage enterprises in terms of the "suitable and feasible basis" criterion an attempt was also made to give these enterprises a factual foundation in existing enterprises. This was done on the basis of size distributions for dairy enterprises in the 1961 Census (Table 4-6). Enterprises which represented the average for the 10 per cent of enterprises with the largest number of cows in 1961 were selected. These enterprises averaged about 18 cows in Prince Edward Island, 26 cows in Nova Scotia and 27 cows in New Brunswick. 1/ The initial-stage budget was developed on the basis of a 25-cow enterprise.

TABLE 4-6

Average Number of Milk Cows in Dairy Enterprises in the Maritime Provinces, 1961

	Average Number of Cows		
	Prince Edward Island	Nova Scotia	New Brunswick
All Census farms	6.4	6.7	7.3
Commercial farms	8.0	11.2	11.3
Dairy farms	11.0	15.6	16.1
Upper 20 per cent *	14.0	19.8	20.3
Upper 10 per cent	17.8	26.5	27.3
Upper 5 per cent	22.0	33.0	34.2

* Average number of milk cows in the 20 per cent of dairy enterprises with the largest number of cows.

Source: Census of Canada, Agriculture, 1961.

1/ In 1966 the top third of Nova Scotia fluid milk herds averaged 30 cows and the top half averaged 22 cows.

a) Basic Assumptions

1) Productivity - The average milk output per cow in the Maritimes was 6,120 pounds in 1965 and increased at the rate of about 90 pounds per cow over the 10-year period preceding 1965. Both the level and rate of increase were lower than in other major milk-producing areas in Canada during this period. Average milk output of 6,100 pounds per cow in the Maritimes in 1965 compared with output levels of about 7,300 pounds per cow in Ontario and about 10,000 pounds in British Columbia. Milk output per cow in above-average herds in the Maritimes is, however, substantially higher than the levels indicated above. An enterprise study in Nova Scotia in 1965 reported average milk output of about 8,100 pounds per cow with the above-average enterprises reporting 8,700 pounds per cow. 1/ Herds in the Dairy Herd Improvement Program reported average production levels of 9,400 pounds per cow in Nova Scotia and 9,500 pounds per cow in Prince Edward Island in 1965. 2/ For the initial-stage dairy enterprise milk output was estimated at 8,500 pounds per cow.

2) Location - The location assumed for the basic initial-stage enterprise was the Truro area in Nova Scotia. This area is part of the Halifax milk shed and is the main fluid milk area in the province. The effects of location on the profitability of enterprises located in other provinces was calculated on the basis of differences in prices of fertilizers, feed, taxes and other items. Lack of pertinent data prevented comparisons among locations on the basis of differences in physical productivity.

3) Enterprise Organization - It was assumed that all forages are produced on the farm, that all concentrates are purchased, and that all forages are produced on improved land. Dairy herd replacements were assumed to be raised on the farm and the replacement rate was estimated at 20 per cent.

4) Mechanization - A complement of machines adequate for the performance of the main tasks on a dairy farm was assumed. This included a tractor, small truck, plow, harrow, disk harrow, mower, rake, baler and fertilizer spreader. Livestock equipment included a front-end loader, manure spreader, barn cleaner, two-unit milking machine, milk cans and electric can cooler. Hand-feeding of forage and concentrates was assumed.

1/ Dairy Farm Business Analysis, Central and Western Nova Scotia, 1965, Nova Scotia Dept. of Agriculture and Marketing, 1966.

2/ Report of the Nova Scotia Milk Industry Inquiry Committee 1966-67 and Annual Report of the Dept. of Agriculture of the Province of Prince Edward Island, 1966.

b) Input-Output Relationships

1) Feed Input and Milk Output - Feed requirements of dairy cows vary according to level of milk output, quality of cow, etc. The grain-to-forage ratio necessary to obtain a specific level of output is dependent on cow quality and forage quality. Forage intake by cows and, hence, the proportion of nutrient requirements obtainable from forage is affected by forage quality. Protein supplement requirements are dependent on forage quality and the forage-to-grain ratio in the ration. All of these factors affect costs and ultimately the profitability of the dairy enterprise. Since these factors have a bearing on the final outcome of the analysis it is important to specify, in detail, the estimates used for forage input, grain input and nutrient content of feed.

An average quality dairy cow should produce 8,000 pounds of 3.5 per cent milk per year on a grain-to-milk ratio of 1:4 if adequate quantities of medium-quality forage are supplied. 1/ Research at the University of Guelph has shown that a 1,200 pound cow producing 8,000 pounds of 3.5 per cent milk requires only 400 pounds of grain throughout lactation if she is fed as much high-quality hay as she will consume. With good forage (consumed at the rate of 2.5 pounds per cwt. per day) the same cow will require 1,400 pounds of grain to produce the same amount of milk. With medium quality forage 2,700 pounds of grain are required and with fair forage 4,200 pounds will be required. This research showed that grain-to-milk ratios for a specific level of milk output can range from 1:20 to 1:2 depending on the quality of forage fed to the cow. It is essential, therefore, to specify the assumptions made regarding forage quality, forage and grain inputs and milk output in order that the effects of these on enterprise profitability can be indicated.

In this analysis it was assumed that medium-quality hay is fed at the rate of two pounds per day per 100 pounds of body weight. In the summer season when better quality forage is available forage input was assumed to be increased and grain input reduced accordingly. Total grain requirements were estimated at 2,125 pounds per cow per year. The total feed inputs per cow were estimated as follows:

1/ Good quality cows produce 10,000 pounds of milk when the grain-to-milk ratio is 1:4. See Agricultural Planning Data for the Northeastern United States, A.E. and R.S. 51, Pennsylvania State University, University Park, Penn. 1965, p. 33.

Hay - 2.5 tons
Pasture - 2.0 tons (hay equivalent)
Concentrates - 2,125 pounds

The replacement or culling rate assumed for the initial-stage enterprise was 20 per cent. When feed requirements for the replacement heifers and surplus calves were included in the feed input estimates the total feed requirements on a per-cow unit basis were estimated as follows. 1/

Hay - 3.4 tons
Pasture - 2.7 tons (hay equivalent)
Concentrates - 2,265 pounds

Total feed requirements for 20- and 25-cow enterprises are summarized in Table 4-7.

TABLE 4-7

Total Feed Requirements for 20- and 25-Cow Dairy Enterprises

	Unit	20-Cow Enterprise	25-Cow Enterprise
Hay*	Ton	80	100
Pasture	Ton hay equivalent	50	62.5
Concentrates	Ton	22.65	28.3
Milk Replacer	Lb.	1,140	1,425
Calf Meal	Lb.	2,375	2,970

* Includes a 12-per-cent feeding loss allowance and a 5-per-cent allowance for occasional feeding of forage during the periods when pasture production is low. The feeding loss allowance is based on information from the Dept. of Animal Science, University of Saskatchewan, which indicates feeding losses of 8 per cent for good quality forage, 12-15 per cent for medium and 20-25 per cent for poor quality forage.

1/ The estimates of feed requirements for calves and replacement heifers were based on data from Dr. J.M. Bell, Dept. of Animal Science, University of Saskatchewan, Saskatoon.

2) Labour Requirements - The labour requirements of a dairy enterprise (per-cow basis) are dependent on a number of factors. These include scale of enterprise, degree of mechanization, size of farm, productivity of land, climatic conditions, type of housing and operator's experience. Estimates of labour requirements for the milking, feeding and caring for livestock (chore labour) range from about 50 hours per cow for large, highly mechanized operations to upwards of 125 hours per cow for small enterprises. Chore-labour requirements in dairy enterprises vary, mainly, by scale of enterprise, degree of mechanization and type of housing. For enterprises of the size and type considered in the initial-stage analysis estimates of chore-labour inputs range from about 80 to 120 hours per cow and average about 100 hours per cow. 1/

Overhead time requirements are also an important part of the total labour input in farm enterprises. Within this general category are included the time requirements for maintenance and repair of buildings, fences and equipment, obtaining farm supplies, supervision, management of the farm business (farm records, tax returns, planning of daily operations) and business trips (farm financial matters, farm organization meetings, etc.). For enterprises of the size and type examined in this analysis estimates of overhead time requirements average about 600 hours per year. 2/

1/ Sources consulted for information included the following:

1. Farm Management Handbook, A.E. Ext. 440, Cornell University, Ithaca, New York, 1966, p. 81.

2. Metzger, H.B., Loose Versus Conventional Housing of Milk Cows - An Economic Analysis, Bulletin 597, Maine Agricultural Experiment Station, 1961.

3. Midwest Farm Planning Manual, Iowa State University Press, Ames, Iowa, 1965.

4. Dairying Costs and Return, Regina Area - 1965, Economics and Statistics Branch Saskatchewan Dept. of Agriculture, Regina, 1966.

2/ Agricultural Planning Data for the Northeastern United States, A.E. & R.S. 51, Pennsylvania State University, University Park, Penn., 1965.

Labour requirements for hay production for a 25-cow enterprise were estimated at between 300 and 400 hours. When this labour input was added to the requirements for the dairy herd and overhead the total labour requirement of the enterprise was estimated at 3,400 to 3,500 hours, or 135-140 hours per cow.1/ Seasonal labour requirements were estimated at 245 hours per month in the spring season, 440 hours per month in the summer season, 255 hours per month in the fall and 290 hours per month in the winter.

In the winter and summer seasons the work load is excessive if the initial-stage enterprise is viewed as a one-man operation. In the winter season when weather conditions are adverse and days are short, it is unlikely that one man could or would work almost 10 hours per day seven days a week. The work load could, however, be managed with the assistance of some family labour. In the summer it seems likely that the farm operator would hire labour during the haying season. The seasonal labour requirements for hay harvesting are extremely high when considered in terms of the average amount of time suitable for haying, i.e., the amount of time when weather conditions are favourable. Estimates of the amount of labour hired by Maritime dairy farmers were obtained from census data and enterprise studies in Nova Scotia. On farms classified as dairy farms by the 1961 Census, cash expenditures for hired labour averaged $29 per cow. 2/ Farms included in the 1965 Nova Scotia dairy enterprise study paid out $804 per farm or $31.40 per cow for hired labour. 3/ These and other data indicated a total labour input or labour supply of one operator, 15 weeks of hired labour and some family labour for a 25-cow dairy farm.

3) Capital Requirements - The investment capital required for a dairy enterprise has four main components: land, livestock, buildings and equipment. The estimates of capital investment must reflect the estimates used for land productivity, milk output, type of housing, labour efficiency, price levels in the assumed location, etc.

1/ Labour inputs on a group of specialized Nova Scotia dairy farms were estimated at 141 hours per cow. The average number of cows on these farms was 32.

2/ These farms reported an average of 15.6 cows per farm, 90 per cent of gross sales from dairy products and livestock and total capital of $1,200 per cow.

3/ Dairy Farm Business Analysis - Central and Western Nova Scotia, 1965, Nova Scotia Dept. of Agriculture and Marketing, Truro, Nova Scotia, 1966.

The capital investment in livestock in a dairy enterprise must reflect the productivity estimates used for cows and the replacement rate assumed for the herd. In dairy enterprises where replacements are raised on the farm and the replacement rate is about 20 per cent, the investment in livestock is normally about three-quarters cows and one-quarter replacement stock. Where livestock investment is $300 per cow, about $225 is invested in cows and $75 is invested in replacement stock. The Nova Scotia Milk Industry Inquiry Committee indicated an investment of $220 for cows producing 9,000 pounds of milk. This suggests an investment of about $290 per cow unit for cows and replacements. This estimate of capital in livestock was used in the initial-stage analysis. For purposes of comparison estimates of livestock investment in dairy enterprises were obtained from a number of other sources (Table 4-8).

The capital requirements for buildings vary by type of housing, size of enterprise, degree of mechanization and feeding system used. The building complement assumed for the 25-cow initial-stage enterprise is one which is typical of that size of enterprise in the selected location. This includes a stanchion or stall-type of barn, storage facilities for grain and hay, a milk house and machine storage space for the main items in the equipment complement.

The building investment estimate for the initial-stage enterprise was based on replacement costs of the main components in the building complement. These were estimated as follows:

Barn (including milking equipment)	-	$ 350 per cow
Milk room (including cooler)	-	2,000
Machine shed	-	800
Water system (well and pump)	-	500
Barn cleaner	-	2,000
Grain storage	-	300

The total replacement cost of buildings and facilities for a 25-cow enterprise was estimated at $14,350 or $575 per cow.

The capital investment in machinery and equipment was estimated on the basis of replacement costs of the components of the machine complement (Table 4-9). Replacement costs were based on 1967 machinery prices in the Maritimes. The replacement cost for the complete machine complement was estimated at $14,100 or $565 per cow. Average investment in machinery was estimated at $7,755

or $310 per cow for the 25-cow enterprise. 1/

TABLE 4-8

Livestock Investment and Milk Output Per Cow in Dairy Enterprises

		Livestock Investment	Milk Output	Number of Cows/Farm
		$	lb.	no.
Maine *	- Stall Barns	365	10,350	53
	- Loose Housing	392	10,400	53
Vermont ‡		230	7,200	28
Vermont #	- Small	297	10,520	28
	- Medium	340	11,270	42
	- Large	315	11,235	71
Ontario **	- Average	360	9,608	34
	- Above Average	380	10,259	45
Census ‡‡	- N.S. Dairy Farms	259	n.a.	16

* Metzger, H.B., Loose Versus Conventional Housing of Milk Cows - An Economic Analysis, Bulletin 597, Agricultural Experiment Station, Orono, Maine, 1961.

‡ Tremblay, R.H., Dairy Farming in Vermont, Bulletin 617, Agricultural Experiment Station, Burlington, Vermont, 1960.

ELFAC Farm Business Analysis 1965, Misc. Pub. 41, Agricultural Experiment Station, Burlington, Vermont, 1965.

** Ontario Farm Management and Accounting Project for 1965, Pub. No. AE/65066/7, Farm Economics and Statistics Branch, Ontario Dept. of Agriculture, 1966.

‡‡ Census of Canada, Agriculture, D.B.S., 1961.

1/ Average investment was assumed to be one-half of replacement cost plus a 10 per cent salvage value or, in other words, 55 per cent of replacement cost.

TABLE 4-9

Replacement Costs of the Machine Complement

For a 25-Cow Dairy Enterprise

Machine	Size or Type	Replacement Cost
		$
Tractor	35-40 H.P.	4,200
Truck	3/4-ton	3,000
Plow	3 (14-inch)	550
Disc (Tandem)	8-foot	375
Harrow	12-foot S.T.	250
Fertilizer Spreader	10-foot	300
Mower	7-foot P.T.O.	500
Rake	8-foot	550
Baler	P.T.O.	1,500
Bale Elevator	20-foot	125
2 Trailers	3-ton, 5-ton	500
Broadcast Seeder	P.T.O.	400
Front-End Loader		500
Manure Spreader	100-bushel	850
Tools		500
Total		14,100

The capital requirements for land are dependent on land values which in turn are affected by physical productivity (soil type, topography, fertility, drainage and climate are factors affecting it), location, adaptability to mechanization, markets for agricultural products and other factors. Accurate estimates of investment in land are difficult to obtain for the following reasons:

i Data are insufficient.

ii Data which are available often lump improved land, unimproved land and buildings into one category; hence it is impossible to estimate accurately the value of improved land, land used for crops, improved pasture, etc.

iii Data which are available give little indication of the productivity of land. In areas where soil management practices (liming, fertilization, drainage) can result in very significant changes in productivity, measures of soil acidity, fertility level, adequacy of drainage and other factors are needed to assess land values.

The points listed indicate a need for research to develop some measure which reflects the level or condition of the various factors which affect productivity. In order to make accurate assessments of the potential of Maritime agriculture or any agricultural enterprise in the region better measures of physical productivity than are now available need to be developed. The situation could be improved substantially if enterprise studies included data on acreages, yields, production practices and other forms of physical information. Estimates of investment in land and other forms of capital are of little value for farm planning or as a basis for assessing the potential of a particular enterprise unless the related physical data are also provided.

Investment in land was estimated at $250 per cow in the initial-stage analysis. This estimate was supported by information from studies in Nova Scotia. The Nova Scotia Milk Industry Inquiry Committee estimated investment requirements for land at $225 per cow, plus $45 per cow for fencing, for a total of $270 per cow. 1/ A group of specialized dairy farms in Nova Scotia reported land investment in the $200 to $300 per cow range. 2/

The total capital requirement for the 25-cow enterprise was estimated at $41,950 or $1,680 per cow on the basis of replacement costs (Table 4-10). On the basis of average investment in buildings and machinery the total capital requirement was estimated at $29,150.

1/ The investment estimate was based on 3 acres per cow at $75 per acre and fencing costs of $15 per acre.

2/ Unpublished data from the Economics Branch, Canada Dept. of Agriculture, Truro, Nova Scotia.

TABLE 4-10

Capital Requirement for a 25-Cow

Dairy Enterprise

Item	Replacement Cost		Average Investment	
	Per Cow	Total	Per Cow	Total
	------------------dollars------------------			
Land	250	6,250	250	6,250
Buildings	575	14,350	315	7,900
Machinery	565	14,100	310	7,750
Livestock	290	7,250	290	7,250
Total	1,680	41,950	1,165	29,150

c) Enterprise Budget

1) Gross Income - The sources of income for specialized dairy enterprises are milk, cull cows and surplus calves. The level of income depends on the number of cows, output per cow and milk and livestock prices. For an established enterprise the level of income depends, to a large extent, on whether milk is sold on the fluid market or for manufacturing, i.e., it is dependent on price. The gross income for the initial-stage enterprise at various price levels is indicated below (Table 4-11). Each 50-cent-per-cwt. change in price changes the gross income of this enterprise about $1,060.

The gross income estimate used in the calculation of net income was based on a milk price of $4.40 per cwt. This assumed a price of $3.30 per cwt. plus a federal subsidy of $1.21 per cwt. less 11 cents retained for export aid. Total gross income was estimated as follows:

Milk -	8,500 lbs. per cow @ $4.40/cwt.	$9,350
Beef -	5 cows @ 1,200 lbs. @ $32.00/cwt. dressed	960
-	19 calves @ 200 lbs. @ $25/cwt. live	950
	Total	$11,260

TABLE 4-11

Gross Income of a 25-Cow Enterprise at Milk Prices Ranging from $3.00 to $6.00 Per Cwt.

Price Per Cwt.	Milk * Sales	Livestock ‡ Sales	Gross Income
-----	-----	dollars	-----
3.00	6,375	1,910	8,285
3.50	7,438	1,910	9,348
4.00	8,500	1,910	10,410
4.50	9,562	1,910	11,472
5.00	10,625	1,910	12,535
5.50	11,688	1,910	13,598
6.00	12,750	1,910	14,660

* This assumed milk sales of 8,500 pounds per cow.

‡ The estimate was based on price quotations issued by Canada Packers Limited, St. John, N.B., for Utility and Manufacturing grades of cows in 1966 and 1967. Veal calves were priced at $25 per cwt.

Producer milk prices in the Maritimes vary by area, province, over time and according to utilization. The average price paid for all milk produced in Nova Scotia increased from $3.34 per cwt. in 1956 to $4.10 per cwt. in 1965 (Table 4-12). Prices in the Maritimes currently range from slightly over $3.00 per cwt. for manufacturing milk to over $6.00 per cwt. in some fluid milk markets. Prices for fluid milk range from $5.13 per cwt. in Prince Edward Island to $6.20 per cwt. in some areas in Nova Scotia. The price paid for manufacturing milk is currently about $3.30 per cwt. Federal subsidies have in recent years resulted in prices of $4.00 or more per cwt. for manufacturing milk. In the 1966-67 dairy year the price of manufacturing milk was about $4.00 per cwt. of which about $0.75 was a direct payment from the Agricultural Stabilization Board. In the current dairy year the federal subsidy is $1.21 per cwt., less a hold-back of 11 cents per cwt. for export aid. This subsidy is limited to manufacturing milk producers (surplus milk on farms with fluid contracts receives no subsidy) and

TABLE 4-12

Producer Prices for Milk in Nova Scotia, 1956-65

Year	Fluid Milk		All Milk
	Average*	Halifax	
	----------- dollars per cwt. -----------		
1956	4.72	4.60	3.34
1957	5.12	4.95	3.51
1958	5.37	5.33	3.67
1959	5.37	5.33	3.77
1960	5.37	5.33	3.87
1961	5.37	5.33	3.84
1962	5.37	5.33	3.83
1963	5.45	5.33	3.92
1964	5.71	5.71	4.05
1965	6.20	5.71	4.10

* Average for Halifax, Sydney and Truro markets.

Source: Report of the Nova Scotia Milk Industry Inquiry Committee 1966-67.

is paid on a quota basis where the quota is, in the main, based on the output of the previous year. Manufacturing milk producers should, therefore, receive about $4.40 per cwt. in the current dairy year. Gross income of the initial-stage enterprise was calculated on this basis. There is, however, no assurance that prices will be maintained at this level in future years.

2) Expenditures

Feed and Bedding[1/] - All forage requirements were assumed to be produced on the farm while grain, protein supplements, calf feeds and bedding were purchased. The expenditure for these items was estimated as follows:

1/ Prices based on price quotations provided by feed dealers in Truro, 1967.

Grain (dairy ration) 28.3T @ $82.20/T	$2,326 1/
Calf Meal 2,970 lbs. @ $4.50/cwt.	134
Milk Replacer 1,425 lbs. @ $18/cwt.	256
Vitamin A and Minerals @ $5/cow	125
Bedding 17.5T @ $14/T	245
Total	$3,086

Forage Production Costs - The estimate includes only the direct costs of forage production (seed, fertilizer, lime, machine repairs and baler twine). The cost of fertilizer was modified to the extent that manure applications can replace commercial fertilizer. Manure production for use on fields was estimated at eight tons per animal unit per year. 2/ Manure value was calculated on the basis of eight tons being the equivalent of 300 pounds of 15-5-15 fertilizer. 3/ Cash costs of fertilizer were reduced by the value of this amount of commercial fertilizer.

Feed production costs:

Cash Costs	$1,466
Manure Credit 5.25T or 15-5-15 @ $75/T	-394
Net Cash Cost	$1,072

Machinery and Equipment Costs - The estimate of machinery and equipment costs included depreciation, repairs, fuel and insurance costs for power equipment and depreciation costs of other machinery and equipment.

Tractor operation 4/

Fuel and lubricants	$250
Repairs @ 3.5%	147
Depreciation @ 6%	252
Insurance @ ¼%	11
Total	$660

1/ With top quality forage this cost would be reduced by $1,500 or more.

2/ Farm Management Handbook, A.E. Ext. 440, Cornell University, 1966.

3/ Fertilizers for New Brunswick, 1967. The Maritime Fertilizer Council, Moncton, N.B.

4/ Based on 500 hours of use annually, and an average useful life of 15 years.

Car and truck operation for farm use 1/

530 gal. @ 50¢/gal. + 10%	$292
Licence and insurance	100
Repairs @ 3.5% of new cost	105
Depreciation @ 6%	180
Total	$677

Farm machinery and equipment - Depreciation estimates were based on an assumed average useful life of machines of 13 years. Estimates of depreciation were based on a straight-line depreciation schedule, replacement costs and salvage values of 10 per cent of replacement costs. Annual machine depreciation was estimated at 7.5 per cent of replacement costs.

Machinery and equipment depreciation:

$6,900 @ 7.5 per cent	$518

Buildings and Dairy Equipment

Depreciation $14,350 @ 5%	$717
Repairs $14,350 @ 1.5%	215
Insurance $14,350@ $3.35/$1,000	48
Total	$980

Other Costs

Vet and medical 2/	@ $8.00 per cow	$200
Breeding fees 2/	@ $6.00 per cow	150
Milk hauling 2/	@ $0.40 per cwt.	850
Hired labour 3/		750
Utilities 2/	@ $8.00 per cow	200
Dairy supplies 2/	@ $5.00 per cow	125

1/ Based on 8,000 miles per year for farm use, 15 miles per gallon and an average useful life of 15 years.

2/ Estimates provided by Maritime dairy farmers.

3/ Estimated from 1961 census data and enterprise studies at $30 per cow.

Taxes 1/	$ 364
Death loss in cow herd 2/	145
Livestock marketing charges 3/	63
Miscellaneous 4/	100
Total	$2,947
Total Expenditure	$9,940

Per cwt. of milk - $4.68

3) Net Income

i Net income at $4.40 per cwt. of milk.

Gross income	$11,260
Expenditure	9,940
Net income	1,320
Interest on capital (6%)	1,749
Labour income	-429

ii Net income at alternative milk prices.

Price Per Cwt.	Gross Income	Net Income	Labour Income
$3.50	$ 9,348	$ -592	$-2,341
4.00	10,410	470	-1,279
4.50	11,472	1,532	-217
5.00	12,535	2,595	846
5.50	13,598	3,657	1,908

1/ Estimated from 1961 census data for dairy farms at 1.25 per cent of total capital.

2/ Outlook for Saskatchewan Agriculture 1967, Saskatchewan Dept. of Agriculture, Regina, 1966.

3/ Estimated at $5.00 per cow and $2.00 per calf.

4/ Includes such things as cow testing, membership in farm organizations and breed associations, liability insurance and other non-specified expenditures.

iii Net income of the same enterprise in New Brunswick.

Gross income	$11,260
Expenditure 1/	9,640
Net income	1,620
Interest on capital (6%)	1,749
Labour income	-129

iv Net income of a 20-cow enterprise in Prince Edward Island. 2/

Gross income	$8,998
Expenditure	7,770
Net income	1,228
Interest on capital (6%)	1,528
Labour income	-300

Budget Analysis of an Optimum-Scale Dairy Enterprise

Optimum-scale enterprises were described in terms of three objectives which assured (1) that labour inputs were no greater than in other occupations, (2) that the operator's income was comparable to that in other occupations requiring similar levels of skill and (3) that the operator and his family had access to normal social amenities. These objectives provided the basis on which optimum-scale enterprises were selected.

In selecting an optimum-scale dairy enterprise special attention was given to the labour and social objectives. In some enterprises, especially cash crop enterprises, a satisfactory level of income assures reasonable labour inputs and access to social amenities. In dairy enterprises the nature of the labour requirements makes it difficult, if not impossible, to satisfy the labour and social objectives with one-man or even two-man operations. The labour-management problem of dairy farms is not so much one of labour distribution (high seasonal labour requirements) as it is one of insistency of the needs for labour. The labour requirements of dairy farms are highly time-specific and can be varied only slightly in amount by omitting a few less essential tasks.

1/ The difference in expenditure between New Brunswick and Nova Scotia is the net effect of slightly lower feed costs, higher fertilizer costs and lower taxes in New Brunswick than in Nova Scotia.

2/ The difference in expenditure between Prince Edward Island and Nova Scotia is the net effect of lower feed prices, higher fertilizer and lime prices, lower taxes and lower machine costs in Prince Edward Island. The lower gross income in Prince Edward Island is due to the smaller enterprise.

In terms of labour efficiency in dairy farming there is usually a sharp break between the family-size enterprise where young people in the family assist with morning and evening chores and the larger enterprise which must hire a full-time man to help with milking and feeding. The nature of the labour requirements for a dairy enterprise are such that labour is an indivisible or "lumped" input. A larger enterprise requires a greater amount of labour each day, therefore when a dairy enterprise becomes larger than the labour capacity of the operator or operator plus family, in order to use labour efficiently, the enterprise must be enlarged to the point where an additional man is fully employed.

The indivisibility or "lumpiness" of labour inputs for a dairy enterprise makes it necessary for expansion to occur in man-units if labour is to be used efficiently. The question of expanded scale of operations is however, not only one of matching labour requirements to labour supply. Access to normal social amenities was indicated as another objective of expanded scale enterprises. On a one-man or operator-plus-family dairy farm the labour requirements are such that access to these amenities is very limited. On a two-man dairy farm some amenities become more accessible but others, such as regular holidays, days off, etc., still are not since the absence of one man reduces the labour supply by 50 per cent. A three-man operation can provide regular days off, holidays, staggered working hours, etc. and hence, make the normal social amenities available to all members of the labour force. The approximate cost of satisfying the labour and social objectives of an optimum-scale dairy enterprise is the annual wage of one man.

The budget analysis of an optimum-scale dairy enterprise was based on a three-man operation. Such an enterprise could be viewed as basically a two-man operation where the third man would permit the provision of holidays, regular days off and the like. The enterprise would need to be sufficiently mechanized so that the essential daily tasks (milking, feeding, cleaning, etc.) can be performed by two men.

The optimum-scale enterprise assumed higher productivity than the initial-stage enterprise. This is outlined in detail in the budget and included (1) increased productivity of land (2) higher labour efficiency due to the larger number of cows and more highly mechanized feeding and milking systems and (3) higher milk output per cow.

The performance of various sizes of dairy farms in New York and Vermont was examined as basis for establishing output levels for a three-man dairy farm (Table 4-13). These data suggested that a three-man labour force should be able to operate a 75- to 90-cow enterprise with a capital investment of $1,300 to $1,600 per cow. A dairy enterprise of this scale would likely use a loose-housing system, mechanical feeding,

milking parlour, bulk tank and other labour-saving devices. Milk output per man should be in the range from 300,000 to 360,000 pounds per year.

TABLE 4-13

Labour and Capital Inputs and Milk Output on Dairy Farms in New York and Vermont, by Size of Dairy Enterprise

	New York Farms, 1965				Vermont Farms, 1964		
Number of Cows	25	44	54	82	28	42	71
Labour							
Man equivalents	1.3	1.8	2.1	2.7	1.4	1.8	2.9
Cows per man	19	24	26	30	21	25	25
Capital ($ per cow)							
Total	1,543	1,570	1,586	1,622	1,325	1,231	1,386
Land and Buildings	746	732	759	805	774	648	775
Machinery	344	346	341	313	258	241	253
Livestock	351	386	372	401	297	340	315
Milk Output							
Milk sold per cow (cwt.)	112	121	118	124	105	113	112
Milk sold per man (cwt.)	2,156	2,951	3,023	3,760	2,240	2,784	2,849

Source: ELFAC Farm Business Analysis, 1965, Misc. Pub. 41, Vermont Agricultural Experiment Station, Burlington, Vermont, 1965; Farm Management Handbook, A.E. Ext. 440, Cornell University, Ithaca, New York, 1966.

a) Basic Assumptions

1) Productivity - The basic analysis assumed 75 cows at 12,000 pounds per cow on a grain-to-milk ratio of 1:4. Total output was estimated at 900,000 pounds per year or 300,000 pounds per man per year. Hay yields were estimated at 3.0 tons per acre (9.0 tons of silage) and pasture carrying capacity was estimated at one acre per animal unit.

2) Enterprise Organization - The analysis was based on

farm production of forages and replacement stock and purchases of concentrate feeds. Estimates of forage production costs were based on the production of hay and haylage (two cuts per year) with no pasture except that required for replacement stock.

3) Mechanization - Estimates of capital and labour requirements assumed free-stall housing, milking parlour, bulk tank, mechanized feeding of silage and concentrates and hand-feeding of hay. Feed production equipment was assumed to include both hay and silage equipment.

b) Input-Output Relationships

1) Feed Input and Milk Output - The feeding program of the optimum-scale dairy enterprise was based on stored feed with pasture provided only for replacement stock. With good quality forage it was assumed that output levels of 12,000 pounds per cow could be achieved on a grain-to-milk ratio of 1:4. Total feed requirements for the 75-cow enterprise were estimated as follows:

Hay and silage @ 7.0T per cow unit	525T hay equiv.
Pasture for replacements	37.5 acres
Concentrates - Cows @ 1.5T/cow	112.5T
- Replacements	5.25T
- Total	117.75T
Calf Meal @ 125 lbs./calf	4.5T
Milk Replacer	4,260 lbs.

2) Labour Requirements - The budget analysis of the 75-cow dairy enterprise assumed a labour force consisting of an operator and two hired men. The wage rate assumed for hired labour was $80 per week per man or $4,200 per year per man. This estimate of wage rates was based on information from a number of fluid milk producers in the Maritimes. These farmers indicated wage rates ranging from $75 to $100 per week plus housing for dependable, experienced labour. These wage rates are higher than average incomes of workers in both agriculture and non-agriculture in the Maritimes. 1/

The labour input per cow was much lower in the 75-cow enterprise than in the 25-cow initial-stage enterprise. The number of cows per man was the same in both enterprises, despite the higher degree of mechanization in the larger enterprise. Milk output, which is a more

1/ The average income per worker in agriculture in the Maritimes was about $1,000 per year in the 1960-64 period. The income per worker in non-agriculture in the Maritimes in the same period was about $3,400 per year. (See Table 2-1.)

significant measure of output, was, however, about 50-per-cent higher in the larger enterprise. The increase in output per man was, nevertheless, smaller than the changes in scale, capital inputs and productivity would seem to suggest. This resulted from the downward adjustment in the total assumed labour input per man which was made in order to satisfy the labour and social objectives of optimum-scale enterprises. A 25-cow enterprise requires one man's time seven days a week plus (usually) some hired labour and/or family labour. A three-man 75-cow enterprise can provide regular days off, staggered working hours, holidays and the like. The price that must be paid for this is roughly the wage of one man. There is some indication that a three-man enterprise could move up to about 90 cows with the level of capital inputs assumed in this analysis and still be within the bounds established for optimum-scale enterprises. The effect of moving up to this scale with the same labour force was examined in the analysis.

3) Capital Requirements - Estimates of the amount of capital required for the 75-cow enterprise were based on replacement costs for the various components assumed in the complement of buildings, equipment, livestock and land. The estimate of investment in buildings was made up as follows:

Milking parlour, tank and milking equip.	$12,000
Building (Milking)	2,000
Free-stall barn ($250 per cow)	18,750
Silo (with unloader)	7,500
Hay storage	3,000
Grain storage	750
Water system (well and pump)	500
Machinery storage	2,000
Housing (hired labour)	8,000
Total	$54,500

The estimate of capital requirements for machinery and equipment was based on the replacement costs of individual components of the assumed machine complement. This complement included the following:

Item	Description	Replacement Cost
Tractor	60 H.P. Diesel	$ 7,500
Tractor	30-40 H.P.	4,200
Truck	Pickup	3,000
Forage Harvester	With pickup	3,000
Baler	P.T.O.	2,000
Conditioner		850
Mower	7-foot P.T.O.	600

Item	Description	Replacement Cost
Rake	8-foot P.T.O.	$ 600
Forage Wagons	2	4,000
Trailers	2	500
Bale Elevator	24-foot	150
Plow	3 (14-inch)	550
Disc	8-foot	440
Harrow	12-foot	300
Fertilizer Spreader	10-foot	415
Front-End Loader		1,000
Manure Spreader		1,000
Broadcast Seeder		450
Miscellaneous		500
	Total	$31,055

The estimate of investment in land was based on the total requirement for forage production and on acreage values which were assumed to reflect the land productivity estimates used. The following estimates were used:

Hay - 525 T @ 3T/acre = 175 acres @ $100/acre	$17,500
Pasture - 37.5 acres @ $75/acre	2,800
Total	$20,300

Capital requirements for livestock were estimated at $400 per cow unit. This assumed an average value of $300 for producing cows and $100 per cow in replacement stock. The total investment in livestock for the 75-cow enterprise was estimated at $30,000.

The total capital requirement, based on replacement costs, was estimated at $135,855 or $1,810 per cow (Table 4-14). On the basis of average investment in buildings and equipment, total capital investment was estimated at $97,400, or $1,300 per cow. The former estimate is the relevant one for a new enterprise or, very likely, even for an expanding enterprise since most of the equipment and buildings would have to be purchased new. Furthermore, interest charges on borrowed capital would be based on the replacement costs of the new items and not on the average or half-life of these items.

TABLE 4-14

Capital Requirement for a 75-Cow

Dairy Enterprise

Item	Replacement Cost		Average Investment	
	Per Cow	Total	Per Cow	Total
	------------------ dollars ------------------			
Land	270	20,300	270	20,300
Buildings	725	54,500	400	30,000
Machinery	415	31,055	230	17,100
Livestock	400	30,000	400	30,000
Total	1,810	135,855	1,300	97,400

c) Enterprise Budget

1) Gross Income:

Milk - 900,000 lbs. @ $4.40/cwt.	$39,600
Beef - 15 cows @ 1,300 lbs. @ $32.00/cwt. dressed	3,120
- 35 veal calves @ $50 each	1,800
- 20 heifer calves @ $75 each	1,500
Total	$46,020

The estimate of gross income was based on a price of $4.40 per cwt. for manufacturing milk. This is the approximate price which manufacturing milk producers are receiving in the current year; i.e., $3.30 per cwt. plus a federal subsidy of $1.10 per cwt. paid by the Canadian Dairy Commission. This subsidy, however, is paid on a quota based, in the main, on output in the previous dairy year (1966-67). 1/ In the case of the above enterprise the subsidy would be paid on 900,000 pounds only if the quota based on last year's output were 900,000 pounds or more. If, for example, the quota were only 500,000 pounds, the subsidy would be paid on this amount and the remainder would be sold at the basic manufacturing milk price of about $3.30 per cwt. Smaller enter-

1/ In some cases where enterprises expanded between 1966 and 1967 supplementary quotas were granted by the Canadian Dairy Commission.

prises (those with quotas of less than 300,000 pounds) can, in general, expand their quotas to 300,000 pounds and receive the subsidy on all milk up to this amount. Under the current regulations larger enterprises cannot expand their quotas by increasing output.

The current regulations concerning pricing and quotas for manufacturing milk are subject to change, hence it is impossible to estimate, with confidence, the gross income of a manufacturing milk enterprise. Therefore, gross income estimates were calculated for a range of prices (Table 4-15). These estimates comprehend prices over the range from manufacturing milk without subsidy to fluid milk. Each 50-cent-per-cwt. change in the price changes gross income of the 75-cow enterprise by $4,500. This indicates the vulnerability of such an enterprise to pricing policies for manufacturing milk.

TABLE 4-15

Gross Income of a 75-Cow Dairy Enterprise at Milk Prices Ranging from $3.00 to $6.00 Per Cwt.

Milk Price	Milk Sales	Livestock Sales	Gross Income
----------	---------- dollars	----------	----------
3.00	27,000	6,420	33,420
3.50	31,500	6,420	37,920
4.00	36,000	6,420	42,420
4.50	40,500	6,420	46,920
5.00	45,000	6,420	51,420
5.50	49,500	6,420	55,920
6.00	54,000	6,420	60,420

2) Expenditures

Feed and Bedding[1/]

Grain (dairy ration) 117.75T @ $82.20/T	$9,679
Calf Meal 4.5 T @ $90.00/T	405
Milk Replacer 4,260 lbs. @ $18/cwt.	767
Vitamin A & Minerals @ $5/cow	375
Bedding 52.5T @ $14.00/T	735
Total	$11,961

Forage Production

Seed - 34 acres reseeded annually @ $6.00/acre	$ 204
Fertilizer - Hay - 175 acres @ 500 lbs. of 5-10-30 @73.20/T	3,202
- 175 acres @ 150 lbs. of 0-0-60 @ $60.80/T	798
- Pasture - 37.5 acres @ 500 lbs. of 6-12-12 @ $54.65/T	512
Lime - 53 acres @ 2T/acre @ $4.00/T	424
Baler Twine - 250T @ $.80/T	200
Machine Repairs $16,355 @ 3.5%[2/]	572
Total	$5,912
Manure Credit 15.75T @ $75/T[3/]	-1,181
Net Cash Cost	$4,731

Machinery and Equipment

Tractor operation - Total tractor use was estimated at 20 hours per cow or 1,500 hours for the whole enterprise.[4/] This estimate included tractor inputs for forage production and tasks associated with the dairy herd.

1/ Based on feed prices at Truro, Nova Scotia, 1967.

2/ Repairs on machines other than power equipment. The rate assumed an average useful life of about 12 years, for all machines and a total repair cost of about 40 per cent of replacement cost over the life of the machine.

3/ Equivalent of 15.75 tons of 15-5-15 fertilizer.

4/ Tractor input of 20 hours per cow compares with an input of 22.6 hours per cow in a study of large dairy enterprises in Maine; Metzger, H.B., Loose Versus Conventional Housing of Milk Cows - An Economic Analysis, Bull. 597, Maine Agricultural Experiment Station, 1961.

Large tractor - 900 hours @ $1.55/hr.	$1,395
Small tractor - 600 hours @ $1.15/hr.	690
Total	$2,085

Car and truck operation for farm use - Car and truck mileage for farm use was estimated at 12,000 miles per year. Annual car and truck costs were estimated as follows:

Fuel and lubricants - 12,000 miles @ 15 miles/gal. @ $0.50/gal. + 10%	$ 440
Depreciation and repairs @ 17.5% 1/	525
Licence and insurance	100
Total	$1,065

Other machinery and equipment 2/

Depreciation $16,355 @ 7.5%	$1,227

Buildings and Dairy Equipment

Depreciation	$54,500 @ 5%	$2,725
Repairs	$54,500 @ 1.5%	817
Insurance	$3.35/$1,000	182
	Total	$3,724

Other Costs

Vet. and med. @ $8.00/cow 3/	$ 600
Breeding fees @ $6.00/cow 3/	450
Milk hauling @ $0.40/cwt. 4/	3,600
Hired labour @ $350/mo./man 5/	8,400
Utilities @ $8.00/cow 3/	600
Dairy supplies @ $9.00/cow 3/	675

1/ Based on a useful life of eight years (100,000 miles) and repair costs of 50 per cent of replacement cost over the useful life of the machine.
2/ Assuming an average useful life of machines of 12 years. Estimates of repairs costs were included in forage production costs.
3/ Estimates provided by Maritime dairy farmers.
4/ This estimate was obtained from the Report of the Nova Scotia Milk Industry Inquiry Committee 1966-67.
5/ Wages paid to hired labour range widely among farms, between areas and by quality of man hired. Some dairy farmers pay $75 per week, others pay upwards of $100 per week for good men. Housing and utilities are also provided. The estimate used here was based on data from fluid milk enterprises in the Moncton area.

Taxes @ 1.25% of total capital 1/	$ 1,191
Death loss in cow herd @ 3% of value	900
Livestock marketing charges 2/	147
Miscellaneous	200
Total	$16,763

Total Expenditure $41,556

Per cwt. of milk - $4.62

3) Net Income

i Net income at $4.40 per cwt. for milk.

Gross income	$46,020
Expenditure	41,556
Net income	4,464
Interest on capital (6%) 3/	5,844
Labour income	-1,380

ii Net income of the same enterprise at alternative milk prices.

Price Per Cwt.	Gross Income	Net Income	Labour Income
$4.00	$42,420	$ 864	$-4,980
4.50	46,920	5,364	-480
5.00	51,420	9,864	4,020
5.50	55,920	14,364	8,520
6.00	60,420	18,864	13,020

iii Net income of the same enterprise in New Brunswick.

Gross income	$46,020
Expenditure 4/	40,449
Net income	5,571
Interest on capital (6%)	5,844
Labour income	-273

1/ Based on 1961 census data for Nova Scotia dairy farms.

2/ Based on 15 cows at $5.00 and 36 calves at $2.00.

3/ Based on six per cent of average investment. In a new enterprise interest payments on borrowed capital would likely absorb most of the interest charge assumed here. For example, with 75 per cent borrowed capital and interest at five per cent interest payments on debts would be about $5,100.

4/ The lower expenditure in New Brunswick was the net effect of higher fertilizer prices, lower feed prices and lower taxes there than in Nova Scotia.

iv Net income of the same enterprise in Prince Edward Island.

Gross income	$46,020
Expenditure 1/	40,149
Net income	5,871
Interest on capital (6%)	5,844
Labour income	27

v Net income of the same enterprise in Ontario.

Gross income 2/	$48,610
Expenditure 3/	37,360
Net income	11,250
Interest on capital (6%) 4/	6,400
Labour income	4,850

vi Net income of a 90-cow enterprise in Nova Scotia with the same labour force and a price of $4.40 per cwt.

Gross income	$55,850
Expenditure	46,806
Net income	9,044
Interest on capital (6%)	6,520
Labour income	2,524

1/ The lower expenditure in Prince Edward Island was the net effect of higher fertilizer and lime costs and lower feed costs and taxes there than in Nova Scotia.

2/ The higher gross income reflects higher prices for manufacturing milk ($3.54 per cwt. plus federal subsidies) and slightly higher prices for heifer calves.

3/ Expenditures are about 10 per cent lower than in the Maritimes due to lower feed costs and lower milk hauling costs.

4/ Higher land values in Ontario increase the total capital investment, hence the higher interest charge.

Appraisal of the Dairy Enterprise

The budget analysis of manufacturing milk enterprises examined two basic enterprises and indicated the effects of a number of factors on the net incomes which may be derived from these enterprises. The budget for the initial-stage enterprise attempted to portray an "average" or "typical" situation in the Maritime dairy industry. A 25-cow enterprise was used for this analysis. The budget for the optimum-scale enterprise examined a 75-cow enterprise in terms of its ability to fulfill a number of objectives which measure its suitability as a satisfactory economic and social unit in Maritime agriculture. In both enterprises the budgets attempted to reflect the effects of location and prices on net incomes. The effect of location was reflected, mainly, by local differences in prices of supplies. In general, lack of data prevented differentiation among locations on the basis of differences in physical productivity, particularly productivity of the land.

The budget analysis of manufacturing milk enterprises indicated generally unsatisfactory levels of income for this enterprise in the Maritimes. Even at the relatively high price of $4.40 per cwt. for manufacturing milk the net income of the optimum-scale enterprise was only about $5,000. This income was, however, largely a capital return or, in the case of enterprises in a low equity position, an interest charge on the borrowed capital. The optimum-scale enterprise provided virtually no labour return at a price of $4.40 per cwt. The budget analysis indicated that satisfactory labour incomes for this enterprise could not be achieved at prices of less than $5.00 per cwt.

The budget analysis of the optimum-scale enterprise was based on a three-man dairy farm with 75 cows and milk output of 900,000 pounds per year (300,000 pounds per man). The number of cows per man was the same as in the initial-stage enterprise but output per man, in terms of milk, was about 50-per-cent higher in the larger enterprise. The higher capital inputs in the larger enterprise (milking parlour, free-stall housing, partially mechanized feeding, etc.) increased labour productivity and reduced the total labour input per man. This reduction in the total labour input per man was considered necessary to fulfill the labour and social objectives of optimum-scale enterprises. In a three-man dairy farm the price of these labour and social objectives is roughly the annual wage of one man, since the provisions of days off, holidays and the like for all three men represents about one man-year of time. The optimum-scale enterprise was, therefore, considered in terms of an enterprise in which two men could handle the basic tasks associated with the operation of the dairy herd. There is some indication that a three-man enterprise could move up to about 90 cows (about one million pounds of milk) with the degree of mechanization assumed in this analysis and still be within the bounds established for

optimum-scale enterprises. At a price of $4.40 per cwt. this adjustment in scale, assuming no increase in labour inputs, resulted in an increase of about $3,900 in labour income or, in the case of the Nova Scotia situation, a positive labour income of about $2,500. This level of income is still unsatisfactory when considered in terms of the income objective of optimum-scale enterprises. Furthermore, the price of $4.40 per cwt. is higher than that which a manufacturing milk enterprise would be likely to receive. 1/ There is, at present, no assurance that the price in future years will be at this level, nor is there any indication of an established policy in terms of quotas or payment system.

A three-man labour force could handle a much larger enterprise than the 75-cow enterprise described above if labour inputs per man were as large as in the one-man 25-cow enterprise. Satisfactory labour incomes could be achieved at the price level indicated but it is unlikely that such an enterprise would be satisfactory in terms of the labour and social objectives of optimum-scale enterprises. If suitable labour can be obtained at lower wage rates than those used in the budgets the potential for a satisfactory operator labour income would be further improved. Non-labour costs in the 75-cow enterprise were estimated at $4.33 per cwt. (including investment costs) and at $4.16 per cwt. in a 90-cow enterprise. Non-labour costs could be covered at a milk price of $3.62 per cwt. in the 75-cow enterprise and at $3.40 per cwt. in a 90-cow enterprise. 2/ Any income derived as a result of milk prices which are higher than the indicated non-labour costs would be a return to labour. At a price of $4.00 per cwt. the total return to labour (operator and hired) was estimated at $3,420 in the 75-cow enterprise and $5,400 in a 90-cow enterprise.

The budget analysis indicated only small differences among provinces in the cost of milk production. This suggests that fluid milk production will continue to be restricted largely to the milk sheds surrounding the main population centres. No significant comparative advantage in fluid milk production was demonstrated for any individual province or area in the Maritimes. Transportation costs would, in general,

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1/ Under the current regulations of the Canadian Dairy Commission the federal subsidy, which in 1967 was about $1.10 per cwt. was paid on a quota basis, based on the previous year's output. It is unlikely that the quota would ordinarily be large enough to absorb all of the additional milk produced in an expanded enterprise of this kind. An established enterprise could have a quota this large but a new or expanding enterprise could not.

2/ This assumed income from beef at $6,420 in the 75-cow enterprise and at $8,330 in a 90-cow enterprise. The cost estimates included interest on capital at six per cent.

be large enough to counter any small differences in productivity which may exist. A 10-cent difference (per cwt.) between transporting milk from local or outside sources, for example, would more than offset the differences in production costs. There would, therefore, seem to be little potential for any province or area within a province to expand fluid milk production beyond the amount required for the local market.

The situation with regard to manufacturing milk production is, however, somewhat different. Fluid milk production, in the main, is concentrated in the areas in each province best suited to milk production in terms of soils, topography and location. These enterprises will, in general, produce more milk than is required for the fluid market and will, therefore, require a proportionately larger area for it. 1/ The less profitable manufacturing milk enterprises are, therefore, forced to go elsewhere for land. The question of potential for expansion (this potential depends on prices paid for manufacturing milk) is then related to the location of the land areas which are physically adapted to milk production. The land area required for fluid milk production is, however, not large. Assuming 12,000 pounds per cow, a 30-per-cent surplus of fluid milk, fluid milk requirements based on 1966 fluid sales and farm home consumption and three acres of land per cow, the total land requirements for fluid milk production in the Maritimes would be about 160,000 acres: 15,000 acres in Prince Edward Island, 80,000 acres in Nova Scotia and 65,000 acres in New Brunswick (Table 4-16).

In terms of interregional comparative advantage it appears that satisfactory levels of income can be achieved at lower milk prices in other regions. This advantage is due largely to lower feed costs but is also related to higher prices for dairy heifers and manufacturing milk. 2/

1/ Some observers feel that fluid milk enterprises should produce an annual surplus of about 40 per cent in order to assure adequate supplies of fluid milk in all seasons.

2/ Processing plants in Ontario are currently paying about $3.54 per cwt. for manufacturing milk. Federal subsidies of about $1.10 per cwt. are added to this up to the limit of each producer's quota.

TABLE 4-16

Estimated Land Area and Number of Cows Required

For Fluid Milk Production in the Maritimes

	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
Fluid Milk Requirements (000 lbs.) *				
Fluid Sales	21,606	198,696	158,649	378,951
Farm Home Consumed	19,630	23,010	22,360	65,000
Total	41,236	221,706	181,009	443,951
Cows Required for Fluid Milk (no.)				
Based on 12,000 pounds per cow	3,436	18,475	15,084	36,995
Allowing a 30-per-cent surplus	4,910	26,400	21,550	52,860
Land Requirement (acres) ‡				
At 3.0 acres per cow	14,730	79,200	64,650	158,580

* Based on 1966 estimates of fluid sales and farm home consumption in the Quarterly Bulletin of Agricultural Statistics.

‡ Assumes production of a 30-per-cent annual surplus to assure adequate seasonal supplies.

5. BEEF ENTERPRISES

Beef production in the Maritimes is, to a large extent, a byproduct of the dairy industry. A large proportion of Maritime beef is produced either in the form of cull cows and bulls and surplus calves or in supplementary or secondary beef enterprises which rear the surplus calves from dairy enterprises. Specialized beef enterprises and farms where beef is a major enterprise are uncommon in the Maritimes. This lack of specialization and the generally small scale of beef enterprises in the Maritimes suggests that beef production has not been very profitable there. If beef production had been profitable it is likely that more large-scale enterprises would have developed.

The comparative advantage in beef production in the Maritime provinces was examined in this study in terms of two main types of specialized enterprises. These were a cow-calf enterprise and a calf-feeding (feedlot) enterprise. As with the dairy enterprise, budgets were developed for two sizes of enterprises. In the analysis of the dairy enterprise the initial-stage budget attempted to reproduce a situation representative of that found on existing dairy farms. With beef enterprises this was not possible because of the small number and generally small size of most beef enterprises in the Maritimes. Enterprises representative of any significant proportion of existing enterprises would be too small to provide a "suitable and feasible basis" for expansion. The selection of initial-stage enterprises was, therefore, arbitrary. Budgets were developed for 100-cow and 100-feeder enterprises.

The budgets for expanded enterprises were based on a 200-cow enterprise and on a 500-head feeder enterprise. These were considered to be one-man operations with additional labour hired during the cropping season. These enterprises would not be entirely satisfactory in terms of the labour and social objectives of optimum-scale enterprises. The labour inputs in beef enterprises are, however, less demanding than in dairy enterprises, hence there is less need for specific provisions regarding holidays, days off and the like to assure access to social amenities. Labour inputs in beef production are less time-specific than in dairy enterprises and also tend to be relatively low in some seasons; hence many of the normal social amenities are accessible even to the one-man enterprise.

Background Information

The cattle population in the Maritimes has been declining for many years. By mid-1967 it had declined to about 400,000 head from a peak of 691,000 in 1919. From 1941 to 1967, cattle numbers declined over 20 per cent (Table 5-1). Beef production was an important enterprise in the Maritimes

TABLE 5-1

Total Cattle Population, Maritime Provinces, Selected Years

Year	P.E.I.	N.S.	N.B.	Maritimes
	----------	thousands	----------	----------
1941	94	205	207	506
1951	98	166	162	426
1956	124	187	184	494
1961	121	164	160	445
1962	121	163	156	440
1963	121	158	154	433
1964	124	159	153	436
1965	130	157	150	437
1966	125	148	136	409
1967	122	146	131	399

Source: Handbook of Agricultural Statistics, Part IV.

in earlier times but declined rapidly in the face of competition from other areas. In more recent years a large proportion of the decline in cattle numbers originated in the dairy industry (Table 5-2). Since 1941, milk-cow numbers in the Maritimes have declined about 50 per cent while beef-cow numbers increased to the point where they now account for roughly one-quarter of the cow population. Milk cows accounted for 53 per cent of all cattle in the Maritimes in 1941 but by 1967 they had declined to 34 per cent. Part of the increase in beef-cow numbers may be attributed to transfers from dairy enterprises in cases where milk and cream production from these cows has ceased.

Beef enterprises in the Maritimes tend to be very small. Beef cattle and dairy cattle are not completely separated in the census reports but the census data indicate the generally small scale of beef enterprises (Table 5-3). In 1961 only about 5 per cent of the farms with cattle reported more than 48 head. Many of the farms in this category were dairy farms. A further indication of the generally small scale

TABLE 5-2

Cattle, Beef Cows and Milk Cows on Farms,

Maritime Provinces, Selected Years

Year	Total Cattle	Milk Cows	Beef Cows
	--------- thousands ---------		
1941	506	269	n.a.
1951	506	244	9
1956	525	234	26
1961	445	171	30
1962	440	164	33
1963	433	156	36
1964	436	154	37
1965	437	152	39
1966	409	141	40
1967	399	135	43

Source: Quarterly Bulletin of Agricultural Statistics.

of beef enterprises is found in product sales data which reveal that livestock sales, especially cattle, account for a much higher proportion of total sales on small farms than on larger farms.

Beef production in the Maritimes has been estimated at less than half of the region's total requirements.1/ Prince Edward Island produces a surplus, but production in Nova Scotia is estimated at about one-third of total requirements while New Brunswick produces about 40 per cent of its beef needs. Over the 10-year period from 1957-1966 an average of about 62,000 cattle and calves were marketed annually in the Maritimes; about 21,000 in Prince Edward Island, 16,000 in Nova Scotia and 25,000 in New Brunswick (Table 5-4). Cows

1/ Food and Feed Balance Sheet, 1964, (unpublished data) Economics Branch, Canada Dept. of Agriculture, Truro, Nova Scotia.

TABLE 5-3

Average Number and Distribution of Cattle on Farms

In the Maritime Provinces

1951, 1961 and 1966

	Year	Cattle Per Farm	Farms Reporting Cattle				
			Less Than 13	13 to 17	18 to 32	33 to 47	48 or More
		average no.	%	%	%	%	%
P.E.I.	1951	10.8	66	16	15	2	1
	1961	18.5	41	16	29	10	4
	1966	23.2	- not available -				
N.S.	1951	8.3	80	9	9	2	1
	1961	15.5	59	12	18	7	5
	1966	19.0	- not available -				
N.B.	1951	8.0	81	8	8	2	1
	1961	16.1	56	13	20	7	5
	1966	20.1	- not available -				

Source: Census of Canada, Agriculture, 1951, 1961 and 1966.

and bulls account for roughly one-quarter of all cattle marketings in the Maritimes.

The average quality of Maritime beef is much lower than that of beef produced elsewhere in Canada. Data on carcass gradings indicate that less than 2 per cent of Maritime beef qualifies for the choice grade as compared to 42 per cent in Alberta, 41 per cent in Ontario and 33 per cent for Canada as a whole (Table 5-5). Less than 10 per cent of Maritime beef qualifies for the top two grades (choice and good) as compared to about 70 per cent in Alberta, 57 per cent in Ontario and 50 per cent for Canada as a whole. Within the Maritime region, beef quality is generally higher in New Brunswick than in either Prince Edward Island or Nova Scotia (Table 5-6).

Budget Analysis of Initial-Stage Enterprises

Two basic beef enterprises were selected for the appraisal of the comparative advantage of Maritime beef production. The first beef enterprise considered was a cow-calf enterprise in which calves were sold as feeders. The second

TABLE 5-4

Cattle and Calves Marketed, Maritime Provinces

1956 to 1966

Year	P.E.I.	N.S.	N.B.	Maritimes
	number			
1957	21,330	15,405	33,512	70,247
1958	24,467	13,080	33,562	71,109
1959	21,130	10,242	23,761	55,133
1960	15,692	9,639	20,317	45,648
1961	19,044	17,754	20,918	57,716
1962	23,385	22,856	23,403	69,644
1963	17,130	17,592	16,176	50,898
1964	17,473	18,463	21,089	57,025
1965	22,686	21,770	28,723	73,179
1966	24,500	19,015	26,686	70,201
Av.1957-1966	20,684	16,581	24,815	62,080

Source: Livestock Market Review, Canada Dept. of Agriculture, Ottawa.

TABLE 5-5

Cattle Marketings by Selected Grades

Alberta, Ontario, Maritimes and Canada, 1965

	Alberta	Ontario	Maritimes	Canada
	per cent			
Choice	41.7	40.7	1.8	32.9
Good	18.6	16.3	7.4	16.4
Standard	8.9	8.5	17.1	8.4
Commercial 1	2.5	5.7	25.7	4.6
Utility 1	1.1	3.1	11.2	2.6
Manufacturing	9.8	9.5	21.9	15.3

Source: Livestock Market Review, Canada Dept. of Agriculture, Ottawa. Based on carcass gradings at federally inspected packing plants.

TABLE 5-6

Cattle and Calves Marketed as Good and Choice

Maritimes, 1959 to 1965

Year	P.E.I.	N.S.	N.B.
	-------------	per cent	-------------
1959	4.3	7.7	6.4
1960	4.9	9.2	6.5
1961	4.5	7.1	5.1
1962	4.6	9.2	7.0
1963	4.5	8.6	11.1
1964	7.1	11.6	12.6
1965	7.7	12.7	14.6

Source: Livestock Market Review, Canada Dept. of Agriculture, Ottawa.

enterprise examined the feasibility of feedlot finishing of calves. These enterprises and slight modifications of them, some of which are described in the analysis, were presumed to encompass the major enterprise types most likely to have economic significance in the Maritimes. The enterprises selected for the initial-stage analysis were 100-cow and 100-feeder enterprises. These sizes of enterprises were considered minimums for specialized beef production. The following analysis will thus be divided into two parts, Part 1 will deal with the cow-calf enterprise and Part 2 with the feeder enterprise.

Part 1 - Cow-Calf Enterprise

a) Basic Assumptions

1) Productivity - Beef cows were assumed to weigh 1,100 pounds and produce steer calves weighing 425 pounds and heifer calves weighing 400 pounds at weaning. These calves were assumed to be good quality stocker calves. A calving rate of 90 per cent was assumed. The replacement rate was estimated at 15 per cent. Forage yields were the same as in the initial-stage dairy enterprise.

2) Enterprise Organization - On-farm production of hay and pasture and purchase of concentrates and feed additives were assumed. Baled hay was assumed to be the basic winter feed. The effect of using community pasture rather than on-farm pasture was examined in the analysis.

3) Mechanization - The estimates of capital and labour inputs assumed limited housing (pole barn) for the cow herd, ground level storage for baled hay and handfeeding. A complement of machines similar to that used in the initial-stage dairy enterprise was assumed.

b) Input-Output Relationships

1) Feed Requirements - The feed requirements of a cow-calf enterprise vary according to size of cow, number and age of replacements being raised, quality of feed, feeding system, climate and other factors. Forage intake by cows, and hence the proportion of nutrient requirements obtainable from forage, is affected by forage quality. Forage quality also has an important bearing on protein and vitamin supplement requirements. All of these factors affect costs and ultimately the profitability of the enterprise; therefore, it is important to specify in detail the estimates used for forage input, feeding system, forage quality, etc.

The feed input levels used in the basic analysis of the cow-calf enterprise are estimated below. The estimates assumed that average-quality forage forms the basis of the feeding system. The winter feeding period was assumed to be seven months and the grazing season five months. During the winter season the herd was assumed to consist of the following:

85 cows - cull cows would have already been sold.

15 yearling heifers - these are bred heifers which will produce their first calves the following spring.

15 heifer calves - these are kept for future replacements.

4 bulls - sire capacity was estimated at about 25 cows per season.

During the grazing season (150 days) the herd was assumed to consist of:

90 cows and calves - ten cows and heifers which failed to drop calves are sold in the spring.

15 yearling heifers

4 bulls

The feed requirements per head were estimated as follows: 1/

	Hay (tons)	Grain (pounds)	Protein Supplement (pounds)
Mature Cow			
Medium - good hay	2.1	-	-
Fair hay	2.1	-	130
Grass silage	2.1	-	215
Yearling Heifer			
Medium - good hay	1.8	750	-
Fair hay	1.8	750	160
Grass silage	1.8	750	270
Heifer Calf			
Medium - good hay	1.0	450	-
Fair hay	1.0	450	270
Grass silage	1.0	450	270
Bull			
Medium - good hay	2.5	800	-
Fair hay	2.5	800	110
Grass silage	2.5	800	215

1/ Based on: 1) Data from Animal Science Department, University of Saskatchewan, Saskatoon.

2) Beef Production in Nova Scotia, Nova Scotia Dept. of Agriculture, 1962.

3) Beef Husbandry in Ontario, Pub. 509, Ontario Dept. of Agriculture, 1964.

Winter feed requirements for the 100-cow herd were estimated as follows:

	Hay (tons)	Grain (pounds)
85 cows	178.5	-
15 heifer calves	15.0	6,750
15 yearlings	27.0	11,250
4 bulls	10.0	3,200
Total	250.5	21,200 or 10.6 tons

The pasture requirements for the 100-cow enterprise were estimated as follows:

90 cows and calves	90 animal units
15 yearlings	10 " "
4 bulls	4 " "
Total	104 animal units

2) Labour Requirements - The labour requirements of a cow-calf enterprise vary according to scale of enterprise, degree of mechanization, type of housing, climatic conditions (length of feeding season), technical competence of the farm operator and other factors. The labour requirements are affected indirectly by land productivity (acres of land required), topography (size of fields, fencing requirements), climate (amount, frequency and seasonality of rainfall, incidence of fog during the haying season, hours of sunshine, annual snowfall, etc.),extent of farm consolidation (farm fragmentation) and other factors.

Estimates of chore-labour requirements for cow-calf enterprises range widely but tend to average about 15 hours per cow for the size and type of enterprise considered in this analysis. 1/ Estimates of seasonal distribution also range widely. In enterprises where the type of feed and feeding system are similar to those described for this analysis, about 75 to 80 per cent of the labour is required in the winter feeding season with the remaining 20 to 25 per cent required in the pasture season.

1/ This estimate implies a low level of mechanization and/or relatively low labour efficiency. Experienced operators have labour inputs of about 10 to 11 hours per cow in cow-calf enterprises of similar scale. See Hackett,B.A. 1965 Alberta Cow-Calf Enterprise Analysis, Pub. No. 816-420-2, Alberta Dept. of Agriculture.

The labour requirements associated with hay and pasture production are dependent on the number of acres of land required to produce the necessary forage supplies, the production methods used to achieve the assumed yield levels, the degree of mechanization, the efficiency of labour and machine use, weather conditions and other factors. The labour requirements for hay production are heavily concentrated in the harvest season. The problem of high seasonal labour requirements is further aggravated by weather conditions which severely limit the number of days suitable for hay harvesting. Unfavourable weather conditions have the effect of increasing the total labour requirements for hay production since a great deal of time is often spent in waiting for favourable conditions or for the adverse effects of recent unfavourable conditions to be remedied. An important factor to consider in an assessment of inter-area and interregional comparative advantage is the difference in the amount of time available for weather-dependent operations such as hay harvesting. The time available for hay harvesting is governed by factors such as the amount and frequency of rainfall, incidence and duration of fog and heavy dew, hours of sunshine, wind velocity, relative humidity and temperature. In areas where these factors severely limit the amount of time available for hay harvesting, the comparative advantage of forage-consuming enterprises is reduced in a number of different ways. These include (1) lower quality, (2) lower yields, (3) higher harvesting losses, (4) higher labour requirements, (5) higher capital requirements resulting from attempts to counteract the effects of weather through investment in larger, more efficient machines and (6) smaller enterprises due to the fact that there is not enough favourable weather to permit production of an adequate amount of winter feed.

Accurate and meaningful analyses of the inter-regional comparative advantage of enterprises closely associated with weather-dependent activities require measurement of the effect of weather on the time available to do specific operations (e.g., harvesting hay and seeding and harvesting grain crops). Inter-regional differences in the amount of time (days, hours, weeks) available for these activities have important effects on capital requirements, labour and machine efficiency, productivity (yield and quality), risk and on other aspects of comparative advantage.

The labour force for the 100-cow enterprise was assumed to consist of an operator plus a small amount of labour hired during the haying season. Such an enterprise would not provide full employment for the operator during the winter months. With some degree of

mechanization one man could handle an enterprise about twice as large as the one examined in the initial-stage budget.

3) Capital Requirements - The capital requirements of a cow-calf enterprise depend on the assumptions made regarding cow value, building and equipment inventories (degree of mechanization) and land values. Capital requirements are indirectly related to the productivity estimates used for land, crop sequence used, local price levels, etc. Estimates of investment in livestock for cow-calf enterprises range between $160 and $240 per cow unit and usually include each cow's share of the replacement heifers and breeding bulls. In this analysis livestock investment was estimated at $200 per cow unit or $20,000 for the enterprise. Specifically, this estimate valued cows at $170, replacement heifers at $100 and bulls at $250.

The capital requirements for buildings and specialized livestock equipment depend on the degree of mechanization assumed in feeding and managing the cow herd, the shelter requirements in the particular area (climatic conditions), construction costs of buildings and fences and other factors.

The replacement cost of buildings required for a 100-cow enterprise was estimated as follows:

Barn (pole-type) @ $30/cow	$3,000
Feed storage - hay - 250T @ $10/T	2,500
- grain	500
Maternity pens, bull pens, etc.	1,000
Water supply	500
Machine shed and shop	1,500
Total	$9,000

The estimate of capital investment in machinery was based on the replacement costs of the individual items included in the assumed machine complement. The replacement cost estimates for individual machines were based on data collected from farm equipment dealers in the Maritime provinces. The machine complement was assumed to consist of the following items:

Machine	Size or Type	Replacement Cost
Tractor	35-40 H.P.	$ 4,200
Tractor	25-30 H.P.	3,000
Truck	3/4-T	3,000
Plow	3 14-in.	550
Disc (Tandem)	8-foot	500
Harrow	12-foot S.T.	300
Fertilizer Spreader	10-foot	400
Mower	7-foot P.T.O.	600
Rake	8-foot	600
Baler	P.T.O.	2,000
Front-End Loader		1,000
Manure Spreader	100-bus.	1,000
Bale Elevator	24-foot	150
2 Trailers		500
Tools		500
	Total	$18,300

The capital requirements for land must reflect land values consistent with the productivity levels assumed for hay and pasture land. This is particularly important in areas such as the Maritimes where land value is dependent, to a considerable degree on pH, fertility, drainage and other amendable factors. Land can often be purchased for as little as $20 to $30 per acre but to make it productive an additional $50 to $75 per acre is usually required for lime, fencing, fertilizer, etc. Where drainage is required the development cost is still higher. At land values of $75 per acre for hay land and $50 per acre for improved pasture the land investment required for the 100-cow enterprise was estimated at $16,000.

The total capital investment for the 100-cow enterprise was estimated at $63,300 on the basis of replacement costs (Table 5-7). On the basis of average investment in buildings and machinery the total capital requirement was estimated at $51,000.

c) Enterprise Budget

1) Gross Income 1/

Calves	- 45 steers @ 425 lbs. @ $26.45/cwt.	$ 5,058
	- 30 heifers @ 400 lbs. @ $22.56/cwt.	2,707
Cull Cows	- 15 cows @ 1,100 lbs. @ $17/cwt.	2,640
		$10,405

1/ Estimated on the basis of the average price for stocker calves on the Toronto market for the 1963-66 period (Table 5-8).

Calving rate, weaning weight, prices and calf quality all have significant effects on the gross income of cow-calf enterprises. At the above prices each 5-per-cent increase or decrease in the calf crop would increase or decrease gross income about $500. Variations in net income are highly correlated with calving rate since calving rate has little effect on costs except insofar as it is related to the quality (value) of the breeding stock. Weaning weight is another important factor affecting gross and net income of cow-calf enterprises. Weaning weight is governed by the age of the calf, quality and quantity of pasture and quality of the breeding stock. In the above enterprise a 50-pound increase in the weaning weight of calves would increase gross income about $900. Selling price of calves also has an important bearing on gross income. With the assumptions used for the initial calculation of gross income (100 cows, 90-per-cent calf crop, 425-pound steers and 400-pound heifers) each dollar per cwt. change in calf price would change gross and net income about $310. The effect of calf quality on enterprise returns can also be demonstrated in terms of price effects. The price spread between good and common stocker calves is normally about $4.00 per cwt. Marketing common rather than good stocker calves would reduce gross income by about $1,240.

TABLE 5-7

Capital Requirements For

100-Cow Beef Enterprise

	Replacement Costs	Average Investment
	--------- dollars	---------
Land	16,000	16,000
Buildings	9,000	5,000
Machinery	18,300	10,000
Livestock	20,000	20,000
Total	63,300	51,000

TABLE 5-8

Average Prices for Feeder Steers and Stocker Calves at Toronto, 1963-66

Year	Good Feeder Steers	Good Stocker Calves	
		Steers	Heifers
	------------- dollars	per cwt.	----------
1963	25.30	27.15	23.85
1964	22.80	23.63	20.49
1965	22.70	24.70	20.30
1966	27.70	30.30	25.60
Average	24.62	26.45	22.56

Source: Livestock Market Review, Canada Dept. of Agriculture, Ottawa.

2) Expenditures

Feed and Bedding

Grain 10.6T @ $72/T	$ 764
Protein Supplement 9.3T @ $90/T 1/	837
Salt, Minerals, Vitamin A @ $2/cow	200
Bedding 25T @ $14/T	350
Total	$2,151

1/ With good quality forage this input could be eliminated.

Forage Production

Forage Seed 35 acres @ $6/acre	$ 210
Fertilizer - Hay - 130 acres @ 300 lbs. of 5-10-30 @ $73.20/T	1,394
- Pasture - 130 acres @ 300 lbs. of 6-12-12 @ $54.65/T	1,066
- Manure credit 1/	-592
Lime - 65 acres @ 2T/acre @ $5.75/T	748
Baler Twine 254T @ $0.80/T	203
Machine Repairs $8,100 @ 3.5%	284
Total Cash Costs	$3,313

Machinery and Equipment

Tractor operation 2/

Larger tractor 425 hrs. @ $1.35/hr.	$ 574
Smaller tractor 300 hrs. @ $1.25/hr.	375
Total	$ 949

Car and truck operation for farm use

Depreciation $3,000 @ 7.5%	$ 225
Repairs $3,000 @ 3.0%	90
Licence and Insurance	100
Fuel 8,000 miles @ 15 m.p.g. @ $0.50/gal. + 10%	294
Total	$ 709

1/ In the dairy enterprise analysis, manure production for use on fields was estimated at 8 tons per animal unit per year for dairy cows. In cow-calf enterprises, where feed inputs are lower and animals spend less time in confinement both yields and recovery of manure are lower and it seems unlikely that more than 4 tons per animal unit would be recovered for use on fields. This conclusion is supported by the results of a University of Illinois study which estimated manure credits for cow-calf enterprises at about one-half of those estimated for dairy enterprises. On this basis a 100-cow enterprise would produce the equivalent of 7.9 tons of 15-5-15 fertilizer.

2/ Based on 3.0 hours per acre for hay production, 1.5 hours per cow and 1.5 hours per acre of pasture. Estimates of tractor inputs for hay production were obtained from W.J. Dillon, Hay Production Costs and Management, Ontario Dept. of Agriculture, Toronto, 1963.

Other machinery and equipment

Depreciation $8,100 @ 7.5%		$ 608

Buildings

Depreciation	$9,000 @ 5%		$ 450
Repairs	$9,000 @ 1.5%		135
Insurance	$3.35/$1,000		30
		Total	$ 615

Other Expenses

Veterinary and medicine 1/		$ 150
Trucking and marketing charges 2/		293
Hired labour 3/		400
Utilities		100
Taxes 4/		638
Cow losses 5/		400
Bull depreciation		125
Miscellaneous		100
	Total	$2,206
Total Expenditure		$10,551

1/ Estimated at $1.50/cow from Outlook for Saskatchewan Agriculture, '67. Saskatchewan Dept. of Agriculture, Regina, 1966.

2/ Calves at $2.50 per head and cull cows at $7.00 per head.

3/ Hired labour requirements were estimated at 2 man-months at $200 per month.

4/ Estimated at 1.25 per cent of total capital.

5/ Cow losses estimated at 2 per cent of inventory value of livestock.

3) <u>Net Income</u>

i Net income of the basic enterprise.

Gross income	$10,405
Expenditure	10,551
Net income	-146
Interest on capital (6%)	3,060
Labour income	-3,206

ii Net income of the same enterprise when community pasture is substituted for on-farm pasture. 1/

Gross income	$10,405
Expenditure	10,912
Net income	-507
Interest on capital (6%)	2,574
Labour income	-3,081

iii Net income of the same enterprise in New Brunswick.

Gross income	$10,405
Expenditure 2/	10,369
Net income	36
Interest on capital (6%)	3,060
Labour income	-3,024

iv Net income of the same enterprise in Prince Edward Island.

Gross income	$10,405
Expenditure 2/	10,366
Net income	39
Interest on capital (6%)	3,060
Labour income	-3,021

1/ The differences in expenditure, net income and labour income of the enterprises using community pasture rather than on-farm pasture reflect the net effect of reduced capital requirements, lower forage production costs, and pasture costs based on the 1967 fee schedule for Nova Scotia community pastures.

2/ The differences in expenditure among provinces reflects differences in feed and fertilizer prices, taxes and a few other minor items. Differences in physical productivity were not accounted for.

Part 2 - Feeder Enterprise

a) Basic Assumptions

The initial-stage beef-feeding enterprise was based on feedlot finishing of calves. The ratio of steers to heifers fed was assumed to be 60:40. This reflected the fact that cow-calf enterprises retain about one-third of the heifers for replacements. The estimates of productivity, feed requirements, capital inputs, etc., used in the budget were based to a large extent on data from Ontario and Alberta.

1) Productivity - Steers were assumed to weigh 425 pounds and heifers 400 pounds when they enter the feedlot. Steers were expected to gain about 600 pounds over a 300- to 320-day feeding period and heifers about 450 pounds over a 240- to 260-day period. The length of feeding period is affected by the type of ration used. Rates of gain are higher and market weight and finish are achieved more quickly with high-grain rations than with high-forage rations.

2) Feeder Rations - The basic analysis was conducted on the basis of a ration in which the ratio of grain to forage was 1:1 (by weight). The basic feeds were assumed to be hay and purchased grain.

3) Feedlot Facilities - The facilities in the feedlot were assumed to include a loose-housing shelter, fence-line feeding facilities and storage facilities for forage, grain, and other supplies. Purchased feeds were assumed to be delivered to the feedlot. Hand-feeding of hay and concentrates was assumed.

b) Input-Output Relationships

1) Feed Requirements - The feed requirements of a feeder enterprise vary according to the size and type of animal fed, rate of gain, total weight gain during the feeding period, quality of feeds, and other factors (Tables 5-9 and 5-10). Forage quality is an important factor affecting feed requirements. The management skill related to forage quality, nutrient balance and forage-to-grain mixtures is critical in the success of feeder enterprises since feed costs represent a high proportion of total costs and are, in some respects, the main controllable element in feedlot operating costs. Profitability in feeder operations is, to a considerable extent, dependent on the operator's ability to arrive at least-cost combinations of feeds consistent with good rates of gain and feed efficiency. When forages are cheap relative to grains a low grain-to-forage ratio may be used; when forages are more costly this ratio is adjusted accordingly.

TABLE 5-9

Expected Daily Gains and Feed Requirements

of Feeder Cattle

Class of Animal	Purchase Weight	Market Weight	Av. Daily Gain	Days on Feed	Feed Per Cwt. Barley	Feed Per Cwt. Hay	Total Feed For 100 Head Barley	Total Feed For 100 Head Hay
	------------------- pounds	-------------------					bu.	tons
Calves								
Steers	430	1,020	1.9	310	600	300	7,300	88
Heifers	400	850	1.8	250	620	310	5,800	68
Yearlings								
Steers	700	1,075	2.1	180	715	240	5,600	44
Heifers	670	900	1.9	120	740	250	3,550	29
Two-year-olds								
Steers	890	1,150	2.2	120	770	260	4,200	33
Heifers	850	1,000	2.0	75	790	270	2,500	20

Source: Feedlot Finishing of Cattle and Lambs in Western Canada, Pub. 1236, Canada Dept. of Agriculture, Ottawa, 1966.

Quality of forage limits the range over which the grain-to-forage ratio can be varied. For example, with good quality hay, feeders can be finished on a 1:2 grain-to-forage ratio. With average quality hay this is not feasible because of the animal's inability to consume the quantity of forage needed to meet the energy requirements for efficient gains.

The total feed requirements for a 100-feeder enterprise with a 60:40 steer-to-heifer ratio are indicated below. These estimates of forage requirements include a 12-per-cent waste allowance (feeding loss) for medium quality forage and an 8-per-cent allowance for good quality forage.

TABLE 5-10

Effect of Forage Quality and Grain-to-Forage Ratio On Feed Requirements Per 100 Pounds of Gain For Feeder Calves

Quality of Forage	Grain-to-Forage Ratio	Hay	Grain	Protein Supplement
		pounds		
Steers				
Good hay	1:2	680	315	25
	1:1	475	475	-
	2:1	300	600	-
Medium hay	1:2	Not feasible with average quality forage		
	1:1	475	425	50
	2:1	300	575	25
Heifers				
Good hay	1:2	700	325	25
	1:1	490	490	-
	2:1	310	620	-
Medium hay	1:2	Not feasible with average quality forage		
	1:1	490	440	50
	2:1	310	595	25

Source: Based on:

1) Beef Husbandry in Ontario, Pub.509, Ontario Dept. of Agriculture, 1964.
2) Feedlot Finishing of Cattle and Lambs in Western Canada, Pub. 1236, Canada Dept. of Agriculture, Ottawa, 1966.
3) Data from the Animal Science Department, University of Saskatchewan, Saskatoon.

Quality of Forage	Grain-to-Forage Ratio	Hay	Grain	Protein Supplement
		--------	tons -------------	
Good	1:2	166.2	86.0	6.75
	1:1	140.0	129.0	-
	2:1	88.5	163.8	-
Medium	1:1	145.2	116.1	13.50
	2.1	91.7	157.0	6.75

Bedding requirements were estimated at 20 pounds per animal per week for a total of about 45 tons for the 100-feeder enterprise. 1/

2) Labour Requirements - The labour requirements of feeder enterprises vary according to scale of enterprise, degree of mechanization, feeding system used and other factors. Estimates of labour inputs for feeder enterprises of the size and type considered in this analysis average about 2.0 hours per cwt. of beef produced. 2/ Labour requirements for hay production were estimated at 5.0 hours per acre. 3/ The total labour requirements for feed production and operation of the feedlot were estimated at about 1,500 hours.

3) Capital Requirements - The estimates of capital requirements assumed on-farm production of forages, hand-feeding, and replacement costs for machinery and feedlot facilities. On this basis capital requirements were estimated at $26,075 (Table 5-11). Average investment was estimated at $16,875.

1/ Based on estimates obtained from the Animal Science Department, University of Saskatchewan,and Agricultural Planning Data for the Northeastern United States, A.E. and R.S. 51, Pennsylvania State University, 1965.

2/ Based on several sources including the following:

1) Van Arsdall, R.N., Resource Requirements, Investments, Costs and Expected Returns from Selected Beef-Feeding and Beef-Raising Enterprises, AE-4075, University of Illinois, 1965.

2) Agricultural Planning Data for the Northeastern United States, *op. cit.*

3/ Dillon, W.J., Hay Production Costs and Management, Ontario Dept. of Agriculture, 1963.

TABLE 5-11

Capital Requirements for 100-Head

Feeder Enterprise

Item		Replacement Cost
Feedlot		
Shelter, corrals, mangers, etc., @ $40/head		$4,000
Hay storage 150T capacity @ $10/T		1,500
Well and pump		500
Grain storage		500
	Total	$7,500
Machinery and Equipment		
Tractor 30-H.P.		$ 4,000
Truck 1½-2T		3,000
Plow 2 14-in.		350
Disc Harrow 8-foot		450
Mower 7-foot P.T.O.		540
Rake 8-foot		540
Baler P.T.O.		2,050
Manure Loader		550
Manure Spreader		970
2 Trailers		500
	Total	$12,950
Land		
75 acres @ $75/acre*		5,625
	Total	$26,075

* Based on hay yields of 2.0 tons per acre and a grain-to-forage ratio of 1:1.

Source: The estimates were based on data from several sources. These included: (1) R.N. Van Arsdall, op. cit. (2) Farm Business Management, Ontario Dept. of Agriculture, 1966 (3) Data from feedlot operators in Ontario (4) Nova Scotia Farm Management Handbook.

c) Enterprise Budget

1) Gross Income 1/

Steers - 60 @ 584 lbs. dressed @ $40.75/cwt.		$14,279
Heifers - 40 @ 459 lbs. dressed @ $38.75/cwt.		7,114
Less 1.5% death loss		-321
	Total	$21,072

Gross income estimates are highly dependent on price and quality assumptions. The effect of quality on gross income is reflected by price spreads among grades. Normally the price spread between choice and good grades ranges between $1.00 and $1.50 per cwt. and from $1.50 to $2.00 per cwt. between the good and medium grades. In this enterprise a price change of $1.00 per cwt. would change gross income about $550.

2) Expenditures

Feed and Bedding

Grain - 116.1T @ $73.60/T		$8,545
Supplement - 13.5T @ $90.00/T		1,215
Minerals, Vitamins, etc. @ $2/head		200
Bedding - 45T @ $14/T		630
	Total	$10,590

1/ Based on the following estimates of weights, grades, prices, etc.:

1) Steers marketed at 1,025 pounds live weight, heifers at 850 pounds.

2) Dressing percentages of 57 per cent for good steers and 54 per cent for heifers.

3) Price of $40.75 per cwt. dressed for good steers. The price used was the average 1962-66 price in Nova Scotia as reported in the Nova Scotia Farm Management Handbook.

4) Death loss equal to 1.5 per cent of gross sales.

Feeders 1/

Steers - 60 @ 425 lbs. @ $26.50/cwt.	$ 6,758
Heifers - 40 @ 400 lbs. @ $22.60/cwt.	3,616
Total	$10,374

Machinery and Equipment

Tractor - 550 hours @ $1.10/hr. 2/	$ 605
Truck and car - 6,000 miles	600
Other machinery $4,950 @ 6%	357
Total	$ 1,562

Forage Production

Seed - 9 acres reseeded @ $6/acre	$ 54
Fertilizer - 75 acres @ 300 lbs. of 5-10-30 @ $73.20/T	822
Lime - 19 acres @ 2T @ $4.00/T	152
Baler Twine 150T @ $0.80/T	120
Machine Repairs $5,950 @ 2%	119
Total	$ 1,267
Manure Credit	-562
Net Cash Cost	$ 705

Buildings and Feedlot

Depreciation - $7,500 @ 5%	$ 375
Repairs - $7,500 @ 1.5%	112
Insurance - @ $3.35/$1,000	25
Total	$ 512

Other Costs

Veterinary and medicine @ $1.50/head	$ 150
Marketing charges @ $5.00/head	500
Taxes @ 1.25% of total capital	210
Interest on feeders @ 6%	622
Total	$ 1,482
Total Expenditure	$25,225

1/ Assumed buying prices similar to the selling prices used in the cow-calf enterprise budget.

2/ Based on 3.0 hours per acre for forage production and 1.0 hour per head for operations in and around the feedlot.

3) Net Income

i Net income of the basic enterprise.

Gross income	$21,072
Expenditure	25,225
Net income	-4,153
Interest on capital (6%)	1,012
Labour income	-5,165

ii Net income of the same enterprise in New Brunswick.

Gross income 1/	$22,072
Expenditure 2/	24,909
Net income	-2,837

iii Net income of the same enterprise in Prince Edward Island.

Gross income	$21,072
Expenditure 2/	24,256
Net income	-3,184

Budget Analysis of Optimum-Scale Beef Enterprises

The budgets for optimum-scale beef enterprises were based on a 200-cow enterprise and on a 500-head feeder enterprise. These were considered to be basically one-man operations with additional labour hired during the cropping season. In beef enterprises the labour inputs are much less time-specific than in dairy enterprises and are relatively low during some seasons. These features of the labour requirements of beef enterprises allow the labour and social objectives of optimum-scale enterprises to be fulfilled with a smaller labour force than in dairy enterprises. Many of the normal social amenities are accessible to one-man beef enterprises, especially when those enterprises are large enough to warrant a hired man during the cropping season.

The budgets for the expanded beef enterprises assumed better feed production methods, a higher degree of mechanization, and more efficient use of labour than the initial-stage enterprises. Forage production methods and yields were assumed similar to those used in the optimum-scale dairy enterprises. The estimates of capital and labour inputs reflected the higher degree of mechanization assumed for feed production and feeding in these larger enterprises.

1/ The higher gross income reflects the $10.00 per head premium paid in New Brunswick.

2/ The lower expenditure reflects lower grain prices, lower taxes and higher fertilizer costs than in Nova Scotia.

Part 1 - Cow-Calf Beef Enterprise

a) Basic Assumptions (Optimum)

1) Productivity - Beef cows were assumed to weigh 1,100 pounds and produce steer calves weighing 450 pounds and heifer calves weighing 425 pounds at weaning. 1/ These calves were assumed to be good quality stocker calves. A calving rate of 90 per cent was assumed. 1/ The replacement rate was estimated at 15 per cent. Forage yields were estimated at 3.0 tons per acre (9.0 tons of grass silage).

2) Feed Production - All forage crops were assumed to be produced on the farm. The basic feed was assumed to be grass silage. Concentrates required to balance the ration were assumed to be purchased.

3) Mechanization - A complete complement of machines required for forage production and handling was assumed. Facilities for mechanical feeding of silage were included.

b) Input-Output Relationships

1) Feed Requirements - The estimates of feed requirements for the 200-cow enterprise were based on data presented in the budget analysis of the smaller cow-calf enterprise. In that budget, forage inputs and forage production costs were based on hay production but data on feed requirements using grass silage were also presented. The following estimate of feed requirements for a 200-cow enterprise used these same feed input levels and assumed that grass silage was fed. Forage quality was assumed to be higher than in the initial-stage enterprise.

Winter feed requirements for the 200-cow herd were:

	Hay Equivalent (tons)	Grain (pounds)
170 cows	357.0	-
30 heifer calves	30.0	13,500
30 yearlings	54.0	22,500
8 bulls	20.0	6,400
Total	461.0	42,400 or 21.2 tons

1/ An Alberta study, 1965 Alberta Cow-Calf Enterprise Analysis by B.A. Hackett, Economics Division, Alberta Dept. of Agriculture, reported an average weaning weight of 431 pounds and an average calving rate of 89.5 per cent.

On a grass-silage feeding program a protein supplement would be added to balance the ration. Ontario data suggest an input of about one pound per day for mature animals and about 1.25 pounds per day for calves and yearlings. A 200-cow enterprise on a grass-silage program would need about 25 tons of protein supplement per winter on this basis.

2) Labour Requirements - This enterprise was assumed to be basically a one-man operation. Additional labour would be required during the forage harvesting season, but the winter labour requirements for feeding and care of the breeding herd were assumed to be provided by one man.

3) Capital Requirements - The estimates of capital inputs for the 200-cow enterprise assumed land productivity similar to that in the optimum-scale dairy enterprise and a higher degree of mechanization in feed production and feeding than in the 100-cow beef enterprise. The total capital investment, based on replacement costs, was estimated at about $121,450 (Table 5-12). On the basis of average investment in buildings and machinery, total capital investment was estimated at about $100,000.

c) Enterprise Budget

1) Gross Income 1/

Calves - 90 steers @ 450 lbs. @ $26.45/cwt.		$10,712
- 60 heifers @ 425 lbs. @ $22.56/cwt.		5,753
Cull cows - 30 @ 1,100 lbs. @ $16/cwt.		5,280
	Total	$21,745

Calving rate, weaning weight, prices and calf quality all have significant effects on the gross income of cow-calf enterprises. The effects of these factors on the gross income of the 200-cow enterprise were estimated as follows:

1/ Estimated on the basis of the average prices for stocker calves on the Toronto market for the period 1963-66. (See Table 5-8.)

TABLE 5-12

Capital Requirements for 200-Cow

Beef Enterprise

Item		Replacement Cost
Buildings		
Barn (pole-type) @ $30/cow		$ 6,000
Feed storage - silos with unloaders		12,000
- grain		500
Bull pens, well equipment, etc.		1,500
Machine shed and shop		1,500
	Total	$21,500
Machinery		
Tractor - 50-60 H.P.		$ 7,200
- 25-30 H.P.		3,000
Truck - 3/4-ton		3,000
Plow - 3 14-in.		550
Disc (Tandem) - 8-foot		500
Harrow - 12-foot S.T.		300
Fertilizer Spreader - 10-foot		400
Forage Harvester		2,500
Front-End Loader		1,000
Manure Spreader		1,000
Forage Blower		750
Forage Wagons - 2		4,000
Tool and Miscellaneous Equipment		500
	Total	$24,700
Land		
Hay and Silage - 155 acres @ $100/acre		$15,500
Pasture - 210 acres @ $75/acre		15,750
	Total	$31,250
Livestock		
200 cows @ $200/cow unit		$40,000
	Total	$117,450

1. Five-per-cent change in calving rate	$1,000
2. Fifty-pound change in weaning rate	1,800
3. One-dollar-per-cwt. change in selling price	660
4. Marketing common rather than good stocker calves 1/	2,640

2) Expenditures

Feed and Bedding

Salt, Minerals, Vitamin A @ $2/cow	$ 400
Grain - 21.2T @ $72/T	1,526
Protein Supplement 25T @ $90/T 2/	2,250
Bedding 50T @ $14/T	700
Total	$4,876

Forage Production

Seed - 50 acres reseeded @ $6/acre	$ 300
Fertilizer	
Hay - 155 acres @ 500 lbs. of 5-10-30 @ $73.20/T	2,836
- 155 acres @ 150 lbs. of 0-0-60 @ $60.80/T	706
Pasture - 210 acres @ 500 lbs. of 6-12-12 @ $54.65/T	2,869
Lime - 9 acres @ 2T/acre @ $4/T	728
Machine Repairs $11,500 @ 3.0%	345
Total	$7,784
Manure Credit	-1,200
Net Cash Cost	$6,584

1/ Based on a normal price spread of $4.00 per cwt. between good and common stocker calves.

2/ Assumed feeding of grass silage. With grass-legume silage it is likely that the protein supplement could be eliminated from the estimates of feed costs.

Machinery and Equipment

Tractor operation 1/

Larger tractor 625 hrs. @ $1.50/hr.		$ 938
Smaller tractor 450 hrs. @ $1.25/hr.		562
	Total	$1,500

Truck and car operation for farm use 2/

Depreciation $3,000 @ 10%		$ 300
Repairs $3,000 @ 5%		150
Licence and Insurance		125
Fuel and Lubricants		365
	Total	$ 940

Other farm machinery 3/

Depreciation $11,500 @ $7.5%	$ 852

Buildings

Depreciation $24,700 @ 5%		$1,235
Repairs $24,700 @ 1%		247
Insurance $3.35/$1,000		83
	Total	$1,565

1/ Based on 3.0 hours per acre for silage production, 1.0 hours per acre of pasture and 2.0 hours per cow for livestock operations.

2/ Annual mileage estimated at 10,000 miles.

3/ Assumes an average useful life of 12 years.

Other Costs

Veterinary and medicine @ $2/cow	$ 400
Transportation and marketing charges 1/	585
Hired labour 3 mos. @ $200/mo.	600
Utilities	100
Taxes	1,000
Cow losses 2/	800
Bull depreciation @ 20% of value	400
Miscellaneous	200
Total	$4,085

Total Expenditure	$20,402

3) Net Income

i Net income of the basic enterprise.

Gross income	$21,745
Expenditure	20,402
Net income	1,343
Interest on capital (6%) 3/	6,000
Labour income	-4,657

ii Net income of the same enterprise in New Brunswick.

Gross income	$21,745
Expenditure	20,319
Net income	1,426
Interest on capital (6%)	6,000
Labour income	-4,574

iii Net income of the same enterprise in Prince Edward Island.

Gross income	$21,745
Expenditure	20,181
Net income	1,564
Interest on capital (6%)	6,000
Labour income	-4,436

1/ $2.50 per calf and $7 per cow marketed.

2/ Estimated at 2 per cent of livestock investment.

3/ Based on 6 per cent of average investment of $100,000.

Part 2 - Beef Feeder Enterprise

a) Basic Assumptions

1) Productivity - Steers which go into the feedlot at 450 pounds are expected to gain about 600 pounds, over a 300- to 320-day feeding period. Steers are marketed at about 1,050 pounds. Forage yields similar to those in the optimum-scale dairy enterprise were assumed (3.0 tons of hay equivalent per acre).

2) Feeder Ration - The basic ingredients of the feeder ration were assumed to be good quality forage and purchased concentrates. With good quality forage it was assumed that feeder animals could be finished with a grain-to-forage ratio of 1:2.

3) Feedlot Facilities - The facilities in the feedlot were assumed to include a pole barn, tower silo, fence-line feeding facilities, mixing equipment and storage facilities for concentrates and other supplies. Purchased feeds were assumed to be delivered to the feedlot. Mechanized feeding of silage and concentrates was assumed.

b) Input-Output Relationships

1) Feed Requirements - Estimates of feed inputs for feeder cattle with several combinations of grain and forage were presented in the budget analysis of the 100-head feeder enterprise (Tables 5-9 and 5-10). The estimates of feed requirements for the 500-head enterprise were based on these data and assumed a 1:2 grain-to-forage ratio. Data from several sources suggested that good quality forage must be available to achieve efficient gains with this type of ration. The total feed requirements for the 500-head enterprise were estimated as follows:

Hay	- 1,100 tons
Grain	- 472.5 "
Supplement	- 37.5 "

Bedding requirements were estimated at 20 pounds per animal per week for a total of 215 tons for the 500-head enterprise. 1/

1/ Based on estimates obtained from the Animal Science Department, University of Saskatchewan, and Agricultural Planning Data for the Northeastern United States, A.E. & R.S. 51, Pennsylvania State University.

2) Labour Requirements - The labour requirements of a feeder enterprise vary according to the scale of enterprise, degree of mechanization, feeding system used and other factors. With mechanized feed handling and processing equipment it was assumed that one man could handle the tasks associated with feeding and management of the feedlot. Some hired labour would be required in the summer months for crop production and harvesting, cleaning the feedlot and moving cattle into and out of the feedlot. The labour force of the enterprise was assumed to consist of a full-time operator plus a hired man from May to October. A small amount of additional labour would probably be hired during harvest time.

Estimates of labour requirements for feeder enterprises of the size considered in this analysis average about 1.0 hours per cwt. of beef produced. 1/ These estimates include the time required for feeding, buying and selling, feed processing, manure removal, etc. They do not include labour required for production and harvesting of feed. The labour requirements for feed production were estimated at 4.0 hours per acre. For the 500-head enterprise the labour requirement for feed production was estimated at about 1,500 hours. Total labour requirements for the enterprise were estimated at about 4,500 hours.

3) Capital Requirements - The capital requirements of a feeder enterprise vary according to the organization, size and degree of mechanization assumed for the enterprise. The organization of the enterprise has an important bearing on investment and operating capital requirements. Where a large proportion of the feed is produced on the farm, investment capital requirements are higher (land and equipment for crop production) and operating capital requirements are lower than for enterprises which purchase feed supplies. Investment capital requirements per head decrease as the size of enterprise increases and increase as the feedlot becomes more highly mechanized. The investment capital requirements for a 500-head feeder enterprise are itemized in Table 5-13 in terms of the replacement costs of the major components. Total investment in land, buildings and equipment was estimated at about $125,000 on this basis.

1/ The sources consulted for estimates of labour requirements included (1) Van Arsdall, R.N., Resource Requirements, Investments, Costs and Expected Returns from Selected Beef-Feeding and Beef-Raising Enterprises, AE-4075, University of Illinois, 1965. (2) Haythorne, D.F. and Elgaard, K., Alberta Cattle Feeding Study, Pub. 65/11, Economics Branch, Canada Dept. of Agriculture, 1965.

TABLE 5-13

Capital Requirements for 500-Head Feeder Enterprise

Item		Replacement Cost
Feedlot		
Shelter, corrals, mangers, paved lot, etc. at $60/head		$ 30,000
Silos with unloaders*		26,700
Feed mixing equipment, supplement storage, etc.		2,500
Well and pump		500
	Total	$ 59,700
Machinery and Equipment		
Tractor - 50-60 H.P.		$ 7,200
Tractor - 30 H.P.		4,000
Truck - 2 three-ton		6,000
Disc - 8-foot		500
Harrow - 12-foot		300
Broadcast Seeder		450
Fertilizer Spreader - 10-foot		400
Forage Harvester		2,600
Forage Wagons - 2		4,000
Front-End Loader		1,000
Manure Spreader - 100-bu.		1,000
Forage Blower		750
Miscellaneous Equipment		500
	Total	$ 28,700
Land		
370 acres @ $100/acre		37,000
	Total	$125,400

* Based on storage capacity for 3,000 to 3,300 tons of silage and assumed three tower silos (30 by 55) at $6,400 each, three unloaders at $1,500 each and three domes at $1,000 each.

Source: Based on information from the following: (1) R.N. Van Arsdall, Resource Requirements, Investments, Costs and Expected Returns from Selected Beef-Feeding and Beef-Raising Enterprises, AE-4075, University of Illinois, 1965. (2) Farm Business Management, Ontario Dept. of Agriculture, 1966. (3) Nova Scotia Farm Management Handbook, Nova Scotia Dept. of Agriculture and Marketing. (4) Feedlot operators in Ontario and the Maritimes.

c) Enterprise Budget

1) Gross Income 1/

Steers - 500 @ $40.75/cwt. dressed	$120,115

Gross income estimates are greatly affected by price and quality assumptions. The effect of quality on gross income is reflected by price spreads among grades. Normally the price spread between choice and good grades ranges between $1.00 and $1.50 per cwt. and from $1.50 to $2.00 per cwt. between the good and medium grades. In this enterprise a change of $1.00 per cwt. in price would change gross income about $2,950. On the basis of 1966 prices in Saint John, New Brunswick, 2/ the gross income of this enterprise would be $129,370 (Table 5-14).

2) Expenditures

Feed and Bedding

Grain - 472.5T @ $73.60/T	$ 34,776
Supplement - 37.5T @ $90/T	3,375
Mineral Mixture - 5,000 lbs. @ $5/cwt.	250
Bedding - 215T @ $10/T	2,150
Total	$ 40,551

Feeders

Steers - 500 @ 450 lbs. @ $26.50/cwt.	$ 59,625

1/ Based on the following estimates of weights, grades, prices, etc.:

1) Marketed at 1,050 pounds live weight.

2) Dressing percentage of 57 per cent for good steers.

3) Price of $40.75 per cwt. dressed for good steers. The price used was the average 1962-66 price in Nova Scotia as reported in the Nova Scotia Farm Management Handbook.

4) Death loss equal to 1.5 per cent of gross sales.

2/ The average price for good steers in Saint John in 1966 was estimated at $43.89 per cwt. dressed.

TABLE 5-14

Cattle Prices in the Maritimes, Toronto and Montreal, 1966

Class and Grade	Maritimes		Toronto#	Montreal#
	Dressed*	Live‡	Live	Live
	------------- dollars per cwt. -------------			
Steers				
Choice	44.79	26.43	27.05	26.50
Good	43.89	25.02	25.85	25.45
Medium	42.66	22.18	24.30	24.25
Heifers				
Choice	42.93	24.04	25.75	24.90
Good	42.03	22.70	24.45	22.90
Medium	40.79	21.21	22.40	21.10
Stockers				
Good Steers	n.a.	n.a.	30.30	n.a.
Good Heifers	n.a.	n.a.	25.60	n.a.

* Average of 1966 weekly quotations from Rail Grade Beef Price List issued by Canada Packers Ltd., Saint John, N.B.

‡ Converted to live weight prices on the basis of the following dressing percentages: choice steers - 59 per cent; good steers - 57 per cent; choice heifers - 56 per cent; good heifers - 54 per cent; medium steers and heifers - 52 per cent.

\# Livestock Market Review 1966, Production and Marketing Branch, Canada Dept. of Agriculture, Ottawa. Price quoted basis live weight.

Forage Production

Seed - 50 acres reseeded/yr. @ $6.00/acre	$ 300
Fertilizer - 370 acres @ 500 lbs. of 5-10-30/acre @ $73.20/T	6,771
- 370 acres @ 150 lbs. of 0-0-60 @ $60.80/T	1,687
Lime - 92.5 acres @ 2T/acre @ $4/T	740
Machine Repairs - $11,500 @ 3.0% 1/	345
Total	$ 9,843
Manure Credit 2/	-2,812
Net Cash Cost	$ 7,031

Machinery and Equipment

Tractor operation 3/

Large tractor - 1,000 hrs. @ $1.50/hr.	$ 1,500
Small tractor - 600 hrs. @ $1.15/hr.	690
Total	$ 2,190

Truck - 10,000 miles @ $0.16/mile 4/	$ 1,600
Other machinery 5/	
Depreciation - $11,500 @ 7.5%	$ 862

1/ Based on average useful life of machines other than power equipment of 12 years and total repair costs of 35 per cent of replacement costs, i.e., about 3.0 per cent per year.

2/ Equivalent of 37.5 tons of 15-5-15 fertilizer.

3/ Based on 3.0 hours per acre for forage production and 1.0 hours per feeder.

4/ Based on 20 miles per feeder and includes transportation to the feedlot and hauling to market.

5/ Assumes an average useful life of 12 years for machines other than power equipment.

Buildings and Feedlot Equipment 1/

Depreciation	$59,700 @ 5%	$ 2,985
Repairs	$59,700 @ 1%	597
Insurance	@ $3.35/$1,000	200
	Total	$ 3,782

Hired Labour

One hired man - 6.0 months @ $300/month	$ 1,800
Extra labour for harvest - 2 months @ $300/month	600
Total	$ 2,400

Other Costs

Electricity @ $1.00/head	$ 500
Veterinary and medical @ $1.50/head	750
Marketing charges @ $5.00/head	2,500
Taxes	1,500
Interest on feeders, fertilizer and purchased feeds 2/	4,000
Miscellaneous @ 1.0% of operating costs	925
	$ 10,175

Total Expenditures	$128,216

3) Net Income

i Net income of the basic enterprise.

Gross income	$120,115
Expenditure	128,216
Net income	-8,101
Interest on capital (6%)	5,100
Labour income	-13,201

1/ Assumes an average useful life of 20 years for feedlot buildings and equipment.

2/ Based on $80,000 for 10 months at 6.0 per cent. The interest rate on short-term capital may be much higher than 6 per cent.

ii Net income of the same enterprise in New Brunswick.

Gross income 1/	$125,115
Expenditure 2/	126,952
Net income	-1,837
Interest on capital (6%)	5,100
Labour income	-6,937

iii Net income of the same enterprise in Prince Edward Island.

Gross income	$120,115
Expenditure 2/	124,166
Net income	-4,051
Interest on capital (6%)	5,100
Labour income	-9,151

Appraisal of Beef Enterprises

The budget analysis of beef enterprises in the Maritimes was based on two main types of specialized enterprises, namely, cow-calf enterprises and calf-feeding enterprises (feedlot). Two sizes of enterprises were considered for each enterprise type. The budgets for the smaller enterprises (100-cow and 100-feeder enterprises) were based on forage production systems similar to that in the initial-stage dairy enterprise, while the budgets for the larger enterprises (200-cow and 500-feeder enterprises) assumed forage quality and yields similar to the optimum-scale dairy enterprise.

Much of the beef produced in the Maritimes is a by-product of dairy enterprises. Specialized beef enterprises, especially cow-calf enterprises, are few in number and generally very small. This situation is undoubtedly due in considerable measure to the relative unprofitability of beef production in the Maritimes in past years. The few farms which do rely on beef as the major source of income usually have some special characteristics (cheap sources of feeder cattle, high level of managerial ability, some special bargaining power on the market, etc.) which enable them to produce beef profitably.

The budget analyses of beef enterprises in the Maritime provinces indicated that specialized cow-calf enterprises and feeder enterprises based on hay or grass silage and

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1/ The higher gross income reflects the provincial premium of $10 per head in New Brunswick.

2/ The lower expenditure reflects lower prices for feed grain and lower taxes but higher fertilizer costs than in Nova Scotia.

purchased grains are generally not profitable. The returns from cow-calf enterprises appeared large enough to pay operating costs and depreciation charges but provided no return for operator labour or capital. In the case of the 200-cow enterprise net incomes of about $3,700 were indicated when protein supplements were removed as an expenditure. With grass-legume silage this cost reduction could be effected. However, even with this adjustment the labour income was still negative after allowing for interest on capital.

Part of the problem of unsatisfactory returns from cow-calf enterprises is related to the high cost of wintering the breeding herd. If a production system which would enable this cost to be spread over a higher gross income were developed, this enterprise could possibly be less unfavourable. One such possible system would be calving in winter, (say) January, and selling 600 to 650 pound feeders by the fall rather than 400 to 450 pound calves. This system would have two main advantages. First, it would increase gross income about 25 per cent. Second, it would make more effective use of pasture since calves would be old enough to eat substantial quantities of forage by the time the pasture season arrived. The major disadvantages would be an increase of about one-third in winter forage requirements and the additional problems associated with calving during the more severe winter weather. This situation was examined in a preliminary way through adjustments in the budget of the 200-cow enterprise. This partial analysis was based on the following assumptions:

1. A one-third increase in winter forage requirements. This increase would be necessary to satisfy the higher feed requirements of lactating cows.

2. A 20-per-cent increase in pasture requirements. This increase would be necessary to provide forage for calves.

3. No change in labour requirements, purchased feeds, calving rate, equipment complement or buildings. Probably fuller use would be made of available labour in winter.

4. Increases in tractor use, land capital, fertilizer and other cropping inputs resulting from the increased forage requirements.

5. Production of 650-pound steers and 600-pound heifers.

This analysis indicated a better net income position than the budgeted cow-calf enterprise. No return on operator labour was indicated, however, after allowing for interest on capital. This type of enterprise probably warrants some additional investigation under practical farm conditions.

The net incomes of all of the feeder enterprise situations examined in the budget analyses were negative. One of the main reasons for greater losses in the feeder enterprises than in the cow-calf enterprises appeared to be related to the cost of purchased grain. It would appear that it is not economically feasible to finish feeder cattle in the Maritimes on rations which include purchased grain even when that grain forms only one-third (by weight) of the total feed input. This conclusion is supported by data from feeders in Ontario who maintain that feeder cattle cannot be fed profitably on rations which include purchased western grains.

The profitability of beef feeding in any area is dependent, to a large extent, on the ability of that area to produce cheap feeds. The profitability of feeder enterprises in western Ontario and the prairies is related to this ability. In Ontario, corn silage provides this feed. In the Prairies relatively cheap feed grains provide the basis for profitable beef feeding. A budget analysis of a feeder enterprise in western Ontario indicated the profitability of beef feeding in that area (Table 5-15). A labour income of $16,000 was realized from a feeder enterprise with a capacity for 500 feeders and the annual output of one lot of 250 calves and two lots of 250 yearlings. The profitability of this enterprise was related mainly to the relatively low feed costs. Feed costs of 12 cents per pound of gain in this enterprise may be compared with feed costs of about 18 or 19 cents per pound of gain in the budgeted Maritime enterprise.

The question often arises in the Maritimes concerning the potential for beef feeding based on corn silage. Corn silage is being grown with some measure of success in the Annapolis Valley and on small acreages in other parts of the Maritimes. A preliminary examination of beef feeding based on corn silage indicated that where this crop could be grown successfully on a large scale this enterprise might be profitable in the Maritimes. A budget analysis of a feeder enterprise based on feeding corn silage to yearling dairy steers indicated a labour income of about $5,000 (Table 5-16). The analysis assumed feeding two lots of 300 steers per year, weight gains of 400 pounds per steer and average gains of 2.25 pounds per day. Several aspects of the estimates of physical productivity and production costs for corn silage are probably optimistic under Maritime conditions. The data on yields and production costs for corn silage were obtained in the area which is, climatically, the best for corn silage in the Maritimes, i.e., the Annapolis Valley. In other areas production costs per ton would likely be higher. If, for example, one assumes a yield of only 12 tons per acre, instead of 15 tons, and no change in per acre production costs, the labour income of this enterprise is reduced by about half. The estimates of harvesting costs, machine inputs and labour requirements assumed weather conditions which will allow one harvesting unit to harvest 2,650 tons of corn silage. At six to eight acres per day this

TABLE 5-15

Budget For 500-Head Feeder Enterprise in

Western Ontario

Item	Unit		Total
Production Data			
Feeders - Calves	no.		250
Yearlings	no.		500
Buying Weights			
- Calves	lb.		400
- Yearlings	lb.		700
Selling Weights			
- Calves	lb.		1,100
- Yearlings	lb.		1,100
Capital - Land	$	200 acres	120,000
Feedlot	$	Replacement cost	80,000
Equipment	$	Replacement cost	20,000
Cost and Returns			
Gross Income	$	750 @1,100 lbs. @$25/cwt.	203,156
Expenditure			
Feed costs*	$	@0.12/lb. of gain	45,000
Feeders - Calves	$	250 @400 lbs. @$26.45/cwt.	26,450
- Yearlings	$	500 @700 lbs. @$24.62/cwt.	86,170
Tractor	$	1.0 hr./steer capacity @1.60/hr.	800
Building costs	$	Depreciation, repairs, ins.	5,000
Interest	$	6% of $100,000 op. capital	6,000
Other costs	$	Taxes, vet. & med. utilities, transportation, etc.	15,000
Total Expenditures	$		184,420
Net Income	$		18,736
Interest on Feedlot	$	6% of $45,000	2,700
Labour Income	$		16,036

* Includes fertilizer, seed, chemicals and other cropping inputs as well as machine costs, investment costs and added supplements.

TABLE 5-16

Budget for 300-Head Feeder Enterprise in the Maritimes

Based on Feeding Corn Silage to Yearling Dairy Steers*

Item	Unit		Total
Production Information			
Feeders			
Buying Weight	lbs.		700
Selling Weight	lbs.		1,100
Prices			
Buying-live cwt.‡	$		20.63
Selling-dressed cwt.#	$		37.40
Capital			
Feedlot	$	Replacement cost	48,000
Equipment	$	Replacement cost	30,000
Land**	$	235 acres @ $200	47,000
Total	$		125,000
Cost and Returns			
Gross Income	$	600 @ 605 lbs. dressed	134,744
Expenditure			
Feed Production ‡‡	$	Fertilizer, seed, chem., etc.	7,233
Feeders	$	600 @ 700 lbs.	86,646
Purchased Feeds	$	Supp.,minerals,bedding	10,990
Machinery	$	Fuel,depr., repair,ins.	4,800
Buildings	$	Depr.,repair & ins.	3,200
Hired Labour	$	6 mos. hired labour plus 30 days harvesting	2,160
Interest	$	6% of $50,000	3,000
Other	$	Taxes, vet., mktg.,etc.	6,350
Total	$		124,379
Net Income	$		10,365
Interest on Capital	$	6% of $90,000	5,400
Labour Income	$		4,965

* Assumed two lots of 300 steers per year.

‡ Average price for common feeder steers at Toronto,1962-66.

\# Average price for standard grade beef in Nova Scotia, 1962-66.

** Based on 15 tons per acre and corn production in three years out of four.

‡‡ Estimates of feed production costs were based on data from farmers in the Annapolis Valley. These estimates were as follows: fertilizer, $20 per acre; seed, $3.50 per acre; chemicals, $12.50 per acre; tractor inputs, 6.0 hours per acre; protein supplements, $3.50 per ton of corn silage.

would require 25 to 30 harvesting days. Under Maritime climatic conditions this does not appear to be a likely prospect. A further consideration is the general unsuitability of land in the Maritimes for corn silage production.

An adequate evaluation of the potential for beef production in the Maritimes based on corn silage is not possible at this stage because of the lack of pertinent data relating to the physical productivity of this crop in the Maritimes in large-scale, practical farm applications. The budget analysis of the feeder enterprises described in Table 5-16 was based on a number of assumptions relating to corn silage production. These assumptions should be tested in areas which are viewed as having some potential for beef production based on corn silage. Corn silage should also be examined as a source of winter feed for cow-calf enterprises.

The budget analyses of beef enterprises and comparison of these with results achieved elsewhere suggested that these enterprises cannot be pursued in the Maritimes, except under special conditions, in competition with beef production in Ontario and western Canada. The beef enterprises in the Maritimes were examined in terms of beef production on the basis of hay and purchased grain. While these enterprises have not yet been examined fully on the basis of substituting corn silage for hay and grain, preliminary indications are that the producers in competing regions would have substantial comparative advantage in this case also. The advantages are evident largely in terms of feed costs. Efficient beef-feeding enterprises in western Ontario, for example, indicate feed costs in the range of 11.5 to 13.5 cents per pound of gain. Consistent yields of high quality forages and a favourable climate for feeding contribute to the comparative advantage in beef feeding in that region.

The profitability of cow-calf enterprises depends on access to cheap forages. In many areas in western Canada grazing seasons are longer and forage production is cheaper than in the Maritimes. In the western ranching areas, large land areas facilitate the development of large efficient enterprises. A significant proportion of the feeder cattle in western Canada are also produced on what is basically waste land on grain farms. The larger acreages of this waste land (land not suited to grain production) are utilized as pasture while the smaller acreages (meadows, sloughs, etc.) often provide most of the hay for the winter feeding period. During the winter months these enterprises use labour which often has little alternative use. As a result these enterprises can be marginally profitable on these farms. In the Maritimes, on the other hand, pasture production requires land clearing, correction of soil pH, fertilizer and other inputs which increase the cost of both hay and pasture. Substantial climatic limitations in both feeding and feed production are added disadvantages for cow-calf enterprises in the Maritimes.

6. HOG ENTERPRISES

Hog enterprises are important sources of income for Maritime farmers. In recent years, hog production has accounted for roughly 10 per cent of farm cash receipts - 15 per cent in Prince Edward Island, 10 per cent in Nova Scotia, and 5 per cent in New Brunswick. Even so, the Maritime region produces only about half the pork consumed there. This might suggest considerable scope for expansion of hog production in the Maritimes provided it could be done profitably in competition with producers in other regions. The budget analyses of hog enterprises examined profitability of specialized enterprises in the Maritimes and in competing regions. Budgets were developed for three types of enterprises: conventional, weanling and feeder enterprises. 1/

Hog production in the Maritimes is based, to a considerable extent, on imported feeds. Prince Edward Island hog production is based largely on local supplies of feed grains, but in Nova Scotia and New Brunswick the majority of hogs are produced with imported grains. Data on hog production and pork requirements by provinces suggest that hog production has been relatively more profitable in Prince Edward Island than in the other two provinces. The region as a whole produces only about half its pork requirements, but Prince Edward Island produces four or five times its requirements while Nova Scotia and New Brunswick produce only about one-third of requirements.

In the budgets for the initial-stage enterprises the profitability of three relatively small enterprises was examined. As specialized enterprises these would be unsatisfactory in terms of employment, income, efficiency of capital inputs and other measures. The initial-stage budgets were based on a 15-sow conventional enterprise, a 45-sow weanling enterprise and a 180-hog (450 per year) feeder enterprise. The budgets for the expanded or optimum-scale enterprises took into account the income, labour and social objectives established as criteria. The optimum budgets were developed for what were considered to be basically two-man enterprises: a 100-sow conventional enterprise, a 200-sow weanling enterprise and a 1,500-hog (3,750 per year) feeder enterprise. The budgets for these enterprises attempted to take into account interprovincial and interregional differences in prices, quality, feed costs and other factors which affect comparative advantage in hog production.

1/ "Conventional" is used to define those hog enterprises farrowing sows to produce litters of young pigs which in turn are fed to finished slaughter weights before being marketed. Weanling enterprises are similar except that the young pigs are sold to feeders as soon as they are weaned. Feeder enterprises purchase weanlings and feed them to slaughter weights.

Background Information

Hog production in the Maritimes has increased in recent years, reversing the downward trend evident from about 1951 to 1962. The trend was still downward in New Brunswick in 1966. In Prince Edward Island hog numbers in 1966 exceeded the 1951 level. They were almost at the 1951 level in Nova Scotia (Table 6-1). Hog enterprises in the Maritimes tend to be relatively small and most enterprises, especially the smaller ones, are still of the conventional type (farrow to finish). The trend in recent years has been toward larger and more specialized hog enterprises.

The numbers of hogs on various types and sizes of farms tend to be relatively small generally (Table 6-2). The number of hogs produced per year per enterprise would be roughly double those in the table since most enterprises operate on a two-litter system. Hog enterprises tend to be slightly larger in Nova Scotia than in Prince Edward Island, and are larger in both these provinces than in New Brunswick. In 1961 the average enterprise reported 14 hogs in Prince Edward Island, 12 in Nova Scotia and 9 in New Brunswick. By 1966 enterprises had increased in size to 29 hogs per enterprise in Prince Edward Island, 27 in Nova Scotia and 12 in New Brunswick. The changes, especially in Prince Edward Island and Nova Scotia, were due both to increases in the sizes of enterprise and to reductions in the number of the smaller enterprises.

TABLE 6-1

Hogs on Farms, Maritimes, Selected Years

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	------------------- thousands -------------------			
1941	48	44	68	160
1951	76	62	92	230
1956	51	33	64	148
1961	55	47	47	149
1962	49	52	45	146
1963	56	56	46	158
1964	61	56	43	160
1965	70	62	38	170
1966	83	57	34	174
1967	95	65	41	201

Source: Census of Canada, and Quarterly Bulletin of Agricultural Statistics.

TABLE 6-2

Average Hogs Per Enterprise, Maritime Provinces, 1961

Class of Farm	Prince Edward Island	Nova Scotia	New Brunswick
	-------------	number	---------------
All census farms	14	12	9
Commercial farms	17	21	14
Livestock farms	28	41	31
Upper 20 per cent*	44	46	32
Upper 10 per cent	62	75	48
Upper 5 per cent	89	112	70
Economic Classification ‡			
$25,000 and over	184	158	122
$15 - 25,000	72	82	53
$10 - 15,000	40	44	26

* Number of hogs per farm on the 20 per cent of farms with the largest hog enterprises.

‡ Classification of farms by value of products sold.

Source: Census of Canada, Agriculture, D.B.S., 1961.

The number and proportion of farms with hogs in the Maritimes have been declining (Table 6-3). These trends, along with the increases in hog numbers, are indications of the increased size and specialization in Maritime hog enterprises. In recent years the decline in the number of hog enterprises has been much more rapid than the decrease in total farm numbers. Between 1961 and 1966 the number of farms with hogs declined 38.4 per cent relative to a 22.0 per cent decrease in total number of farms.

Receipts from hogs represent an important source of income for Maritime farmers (Table 6-4). In the Maritimes as a whole farm cash receipts from hogs account for about 10 per cent of total cash receipts. In Prince Edward Island receipts from hogs account for about 13 per cent of total farm cash receipts. In Nova Scotia and New Brunswick, they are about 9 and 6 per cent, respectively.

TABLE 6-3

Percentages of Farms with Hogs, Maritime Provinces, Selected Years

Year	Prince Edward Island	Nova Scotia	New Brunswick
	per cent		
1941	70	54	61
1951	73	49	57
1956	56	33	44
1961	53	30	43
1966	44	22	33

Source: Census of Canada, Agriculture, 1961 and 1966.

TABLE 6-4

Farm Cash Receipts from Hogs, Maritimes, Selected Years

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	thousand dollars			
1940	1,051	753	1,459	3,265
1950	4,828	3,062	4,656	12,546
1960	3,178	3,170	3,271	9,619
1961	3,907	3,483	3,622	11,012
1962	3,633	3,952	3,414	10,999
1963	3,587	3,646	2,803	10,036
1964	4,087	3,877	3,057	11,021
1965	5,378	4,834	3,123	13,335
1966	6,725	5,449	3,445	15,619

Source: Farm Cash Income, D.B.S.

The increases in farm cash receipts from hogs in the Maritimes in recent years reflect increases in the number of hogs marketed. Over the 10-year period 1957-1966 the number of hogs marketed in the Maritimes doubled (Table 6-5). The increase occured mainly in Nova Scotia and Prince Edward Island. Data on the number of hog carcasses graded indicate that Prince Edward Island markets about half of the hogs in the Maritimes. Lower average prices in Prince Edward Island are indicated by the fact that cash receipts from hogs in Prince Edward Island represent a smaller share of total cash receipts for the Maritimes than the Island's share of hog marketings. For example, in 1966 Prince Edward Island accounted for 50.4 per cent of the hog carcasses graded in the Maritimes but only 43.0 per cent of farm cash receipts from hogs.

The quality of hogs marketed in the Maritimes is considerably higher than elsewhere in Canada. This is reflected in the higher proportion of Grade A hogs marketed there than in other parts of the country (Table 6-6). This is the reverse of the situation pertaining to beef cattle. In Prince Edward Island, hog grades have been high for many years, and in recent years Nova Scotia and New Brunswick hogs have received comparable grades. In other regions, hog quality has improved but is lower than in the Maritimes. About 56 per cent of the hogs graded in the Maritimes meet the Grade A requirements relative to about 43 per cent in Ontario and Alberta and 42 per cent in Canada as a whole.

TABLE 6-5

Number of Hog Carcasses Graded in the Maritimes, 1957-1966

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes	Inspected* Slaughter
1957	68,561	17,351	32,023	117,935	114,583
1958	77,106	21,218	35,580	133,904	133,437
1959	95,365	33,284	51,747	180,396	181,248
1960	80,014	40,038	48,461	168,513	165,372
1961	81,294	49,781	44,340	175,415	170,148
1962	76,838	57,307	37,469	171,614	168,923
1963	78,928	60,485	36,895	176,308	173,164
1964	90,184	68,238	38,722	197,144	199,971
1965	96,881	78,327	32,647	207,855	210,397
1966	113,351	78,852	32,836	225,039	237,907
Av.	85,852	50,488	39,072	175,412	175,515

* Number of hogs slaughtered in inspected establishments in the Maritimes.

Source: Livestock Market Review, Canada Dept. of Agriculture, Ottawa.

TABLE 6-6

Percentage of Hogs Grading A and B, Maritimes, Alberta, Ontario and Canada, Selected Years

Year	Prince Edward Island	Nova Scotia	New Brunswick	Ontario	Alberta	Canada
			per cent			
1956 - A	55.8	49.8	47.2	33.5	20.2	28.5
- B	35.4	36.2	36.3	51.2	51.4	50.7
1960 - A	53.2	49.9	46.9	34.5	22.4	30.5
- B	36.1	37.0	36.1	46.4	47.6	46.5
1966 - A	55.7	57.4	56.2	43.3	42.8	42.0
- B	36.6	34.0	34.7	44.6	41.0	43.9

Source: Livestock Market Review, Canada Dept. of Agriculture, Ottawa.

Budget Analysis of Initial-Stage Hog Enterprises

The selection of sizes of enterprises for the initial-stage analysis was based partly on census data, and took account of established differences in gross income, investment, operating capital and other characteristics which exist among the three enterprise types. These enterprise types (conventional, weanling and feeder) are not differentiated in the census, hence the selection of initial-stage enterprises could not be based entirely on census size data (see Table 6-2). Conventional enterprises of the size indicated for the upper 5 per cent of all hog enterprises in 1961 would have about 12 sows in Prince Edward Island (180 market hogs per year), 15 sows in Nova Scotia (225 market hogs per year) and 10 sows in New Brunswick (150 market hogs per year). Weanling enterprises would require about 45 sows producing two litters per year (675 weanlings) to produce a level of income similar to that of a 15-sow conventional enterprise. A feeder enterprise would need to gross about $20,000 (450 market hogs) to achieve a similar net income.

Budgets for initial-stage hog enterprises were thus based on enterprises of the following sizes:

1. Conventional enterprise - 15 sows (225 market hogs).

2. Weanling enterprise - 45 sows (675 weanlings).

3. Feeder enterprise - 450 market hogs (180 hogs turned over 2.5 times a year).

Hog enterprises were, until recently, secondary and supplementary enterprises on dairy and other types of farms, and as a result were usually located in the same areas. Recent trends in hog production have been toward larger, specialized enterprises located apart from other enterprises. Since hog enterprises are not land-based they should now tend to locate close to feed supplies and markets, but this tendency may be offset for a time, as in Nova Scotia, by the location of the operators experienced in the hog enterprise. The effects of location on the profitability of hog enterprises were calculated in the budget analyses on the basis of differences in prices, feed costs, taxes and marketing charges.

The areas of greatest concentration in hog production in the Maritime provinces are the Annapolis Valley in Nova Scotia, central Queen's county in Prince Edward Island and the Fredericton-Woodstock area in New Brunswick. Hog production is also important in the Nova Scotia counties north of Halifax, in the Moncton-Sussex area in New Brunswick and in Prince county, Prince Edward Island. The initial-stage hog enterprises are assumed to be located in Prince Edward Island. The effects of locating the enterprises elsewhere are indicated in separate calculations of net incomes.

a) Basic Assumptions

1) Productivity - In both conventional and weanling enterprises sows were assumed to produce two litters per year. Weanling production was assumed to average 7.5 pigs per litter or 15 pigs per sow per year. The data in Table 6-7 indicate that the weaning rate is higher than 7.5 pigs per litter in the Maritimes. But these data fail to take account of the fact that some sows in the herd produce only one litter a year. Data from an enterprise study in Alberta indicate an average productivity level of 1.8 litters per sow per year. 1/

2) Sources of Feed - All feeds were assumed to be purchased as prepared rations and delivered to the farm in bulk. The feeds used include pig starter, hog grower, hog finisher and sow rations.

3) Mechanization - Hog buildings were assumed to be equipped with feeders, waterers and lighting and heating equipment. Bulk storage was provided for feed. Feeding and cleaning were assumed to be done manually.

1/ Hackett, B.A., and Reddon, A.R., 1965 Alberta Hog Enterprise Analysis, Publication No. 816/440-1, Alberta Dept. of Agriculture, Edmonton, 1967.

TABLE 6-7

Pigs Weaned Per Sow Farrowed,

Maritimes, Selected Periods

Year	Period	Prince Edward Island	Nova Scotia	New Brunswick
		----------	number	----------
1964	June to November	8.3	8.2	8.4
1965	June to November	7.9	8.2	8.5
1964-65	December to May	8.5	8.2	7.9
1965-66	December to May	7.9	8.6	8.0

Source: Quarterly Bulletin of Agricultural Statistics.

b) Input-Output Relationships

1) Feed Requirements - The basic ingredients of swine rations are grains and protein supplements. Small amounts of minerals and minor elements are normally required but these are usually provided in commercial supplements, hence when rations are balanced on energy and protein bases they are ordinarily supplied adequately with these other requirements. Estimates of feed requirements by type of animal and type of enterprise are provided in Tables 6-8 and 6-9. The estimates of feed costs were based on the total quantities of mixed rations required in each enterprise.

2) Labour Requirements - The labour requirements in hog production vary by type of enterprise, degree of mechanization, size of enterprise, operator experience, and other factors. The effect of size of enterprise on labour inputs in conventional enterprises may be indicated by the following data from an Alberta enterprise study. 1/ Enterprise size was indicated in this study in terms of cwts. of live market hog produced per year and labour inputs were estimated on a per-cwt.-of-live-hog basis:

1/ Hackett, B.A. and Reddon, A.R., *op. cit.*

Size of Enterprise (cwt.)	Labour Requirements (hours per cwt.)
Less than 250	1.9
250 - 499	2.0
500 - 999	1.6
1,000 or over	0.7
Average (580)	1.5

TABLE 6-8

Feed Requirements for Hogs

Type of Hog	Grain	Supplement	Prepared Feeds	Total
	pounds			
Brood sow	2,200	300	-	2,500
Mature boar	2,200	300	-	2,500
Market hogs up to 40 lbs.	-	-	40	40
40 - 200 lbs.	540	70	-	610

Source: Based on data from sources which included the following:

1) Hog enterprise data collected by the Economics Branch, Canada Dept. of Agriculture, Truro.

2) Animal Science Department, University of Saskatchewan, Saskatoon.

3) Farm Business Management, Ontario Dept. of Agriculture, 1966.

TABLE 6-9

Total Feed Requirements for Initial-Stage Hog Enterprises

Enterprise	Size	Grain	Supplement (35 Per Cent)	Prepared Feeds
		-----------	tons	-----------
Conventional	15 sows	78.35	10.27	4.5
Weanling	45 sows	51.70	8.05	13.5
Feeder	450 hogs	121.50	15.75	-

The direct labour requirements for the initial-stage hog enterprises were estimated as follows: 1/

Conventional enterprise - 60 hours per sow

Weanling enterprise - 30 hours per sow

Feeder enterprise - 2.0 hours per market hog produced.

The total labour requirements for initial-stage hog enterprises were estimated as follows: 2/

Conventional enterprise (15 sows) - 900 hours

Weanling enterprise (45 sows) - 1,350 hours

Feeder enterprise (450 feeders) - 900 hours

1/ The estimates of labour requirements were based on information from several sources. These included:
1) Hog Production in Nova Scotia, Nova Scotia Dept. of Agriculture and Marketing, 1966.
2) Stephens, J.R., Swine Production in Ontario, Conventional Enterprises, Costs, Returns and Management, Ontario Dept. of Agriculture and Food, 1966.
3) Hackett, B.A., and A.R. Reddon, op. cit.
4) Agricultural Planning Data for the Northeastern United States, A.E. & R.S. 51, Pennsylvania State University, 1965.

2/ An additional labour input would be required for tasks not directly associated with the feeding and care of hogs. This overhead labour input has been estimated at 15 per cent of the total labour by R.N. Van Arsdall, Resource Requirements, Investments, Costs and Returns from Hog Production Systems in Illinois, AE-4074, Illinois Agricultural Experiment Station, 1965.

The labour requirements for hog enterprises are fairly evenly distributed on a seasonal basis. In conventional and weanling enterprises peaks in labour requirements occur during farrowing time but these seasonal peaks are much less extreme than in other types of enterprises, especially when farrowings are spread over an extended period. In feeder enterprises, labour requirements are fairly uniform both on seasonal and monthly bases. Since the feeding system does not vary by seasons as it does in dairy and beef enterprises, climate has very little effect on seasonal labour requirements in hog enterprises.

None of the enterprises described above provide full-time employment for the operator. The enterprises would have to be much larger to provide full employment for one man. The increased labour efficiency resulting from a larger scale and higher capital inputs would substantially reduce labour inputs per hog. Some estimates suggest that conventional enterprises with 80 sows, weanling enterprises with 150 sows and feeder enterprises feeding 2,500 hogs per year can be handled by one man. These enterprises would, however, be considered unsatisfactory in terms of the labour and social objectives established for optimum-scale enterprises.

3) Capital Requirements - Capital for hog enterprises is of several types and kinds. Investment capital is required for buildings, equipment and breeding stock. Operating capital is required for feed, feeder hogs and supplies. The various types and kinds of capital are required in differing proportions for the various enterprises. For example, investment capital requirements are much higher relative to operating capital requirements in weanling enterprises than in feeder enterprises. Consequently the two types of enterprises have substantially different financing requirements. The relatively high investment capital requirements of a weanling enterprise require access to a source of long-term credit, whereas the feeder enterprise requires access to large amounts of short-term credit.

Investment capital requirements were estimated on the basis of replacement costs. The estimates used reflect construction costs and equipment prices in the Maritimes and the degree of mechanization assumed for the enterprises. Depreciation and repair cost estimates were based on replacement costs, and interest on capital was based on the average investment, i.e., value of breeding stock plus 55 per cent of the replacement cost of buildings and equipment.

Capital requirements for hog enterprises were based on the following estimates of replacement costs:

Buildings 1/	- farrowing unit	$ 300 per sow
	- feeders	30 per hog
	- service building	800
Equipment	- truck (pickup)	3,000
	- water system	500
Livestock	- brood sows	75 each
	- boars	100 each

The total capital requirements for conventional, weanling and feeder enterprises were estimated as follows:

Enterprise	Size	Buildings	Equipment	Live-Stock	Total
		----------- dollars -----------			
Conventional	15 sows	5,300	3,500	1,225	10,025
Weanling	45 sows	14,300	3,500	3,575	21,375
Feeder	450 hogs	6,200	3,500	-	9,700

c) Enterprise Budgets

Conventional Enterprise (Initial)

1) Gross Income 2/

Market hogs 221 hogs 3/ @ 150 lbs. dressed weight @ $28.60/cwt.	$9,481
Grade A premium on 133 hogs	399
Total	$9,880

1/ Estimates were based on data from the Nova Scotia and Ontario Depts. of Agriculture. The estimates of building costs also include costs of feeders, waterers, feed storage facilities, ventilation fans, etc.

2/ Based on a price of $30 for Grade A hogs at Moncton and marketing of 60 per cent A's and 40 per cent B's. Prices in Prince Edward Island were estimated at $1.00 per cwt. below the mainland price.

3/ A 2-per-cent death loss was assumed between weaning and marketing.

The gross income of conventional hog enterprises varies according to size of enterprise, number of hogs sold per litter, price, quality and time of marketing. The effects of these factors on the gross income of this enterprise were summarized as follows:

1. One-per-cent change in dressing percentage	$130
2. Increase or decrease of one hog marketed per sow per year	686
3. One-dollar-change in price	332
4. Marketing at 5 per cent above or below average price	490

The effects of these factors were calculated using a base price of $30 per cwt. for Grade A hogs and marketing of 60 per cent A's and 40 per cent B's. The average price for Grade A hogs at Moncton and Halifax over the 1960-66 period was $29.66 per cwt. (Table 6-10). Prices were much higher than $30 in 1965 and 1966 but declined to about $30 in the first quarter of 1967. 1/

The time of year when hogs are marketed has an important bearing on gross income since prices normally vary seasonally. The seasonal variation in hog prices for the 1956-1965 period at Toronto is indicated in Table 6-11. The average price in each month is given as a percentage of the average price over the 10-year period. Seasonal variations in prices at other markets usually reflect these variations at Toronto.

2) Expenditures

Feed 2/

Sow ration	21.25T @ $80.00/T		$1,700
Hog grower	22.50T @ $77.80/T		1,751
Hog finisher	46.1T @ $74.20/T		3,422
Pig starter	4.5T @$115.00/T		517
		Total	$7,390

1/ Farm Economics, Nova Scotia Dept. of Agriculture and Marketing, Truro, April, 1967.

2/ Based on prices at Summerside, Prince Edward Island, July, 1967.

TABLE 6-10

Prices For Grade A Hogs, Maritimes, 1960-66

Month	1960	1961	1962	1963	1964	1965	1966
	--------------			dollars per cwt.			--------------
January	23.36	31.01	26.30	30.23	26.88	27.94	42.25
February	21.90	30.26	26.96	29.25	27.40	28.75	41.83
March	21.81	26.90	26.50	27.24	26.00	28.10	35.42
April	22.31	25.61	27.00	25.25	27.61	28.00	32.70
May	23.53	27.25	28.20	27.00	29.26	30.55	35.60
June	26.86	29.43	31.00	30.00	28.46	35.18	38.00
July	27.88	30.80	32.40	29.71	28.29	35.68	34.65
August	27.05	29.25	32.06	28.69	28.29	36.25	33.83
September	28.06	29.18	30.62	27.53	28.12	36.06	33.50
October	27.46	28.23	29.80	26.08	27.18	36.00	33.40
November	27.46	27.59	30.18	26.33	27.68	37.37	33.25
December	29.61	26.87	30.62	28.69	27.56	40.55	32.50
Average	25.64	28.53	29.31	27.50	27.72	33.37	35.58

Source: Agricultural Statistics 1966, Province of Nova Scotia, Publication 7, Nova Scotia Dept. of Agriculture and Marketing, 1966. Based on prices at Moncton and Halifax. Prices in Charlottetown were about $1.00 per cwt. lower.

TABLE 6-11

Seasonal Variation in Hog Prices at Toronto, 1956-1965

Month	Per cent of 10-year Average Price
January	95.5
February	98.5
March	95.5
April	94.0
May	97.0
June	105.0
July	107.5
August	109.5
September	107.0
October	99.0
November	97.5
December	97.0

Source: Farm Business Management, Ontario Dept. of Agriculture, 1966.

Buildings and Equipment

Depreciation	$5,800 @ 5%		$ 290
Repairs	$5,800 @ 1%		58
Insurance	$5,800 @ .33%		19
		Total	$ 367

Truck Operation

5,000 miles @ 11.6¢/mile		$ 580

Livestock

Sow depreciation @ 10% of value		$ 112
Boar depreciation @ $35/boar/year		35
	Total	$ 147

Other Costs

Veterinary and medical 1/		$ 210
Bedding 2/		-
Electricity 3/		140
Transportation 4/		110
Taxes 5/		21
Death loss in breeding stock 6/		37
Interest on operating capital 7/		111
Miscellaneous 8/		100
	Total	$ 729

Total Expenditures $9,213

Expenditure per hog marketed - $41.69

1/ Estimated at $14.00 per sow.

2/ Bedding costs and manure credits were assumed to cancel each other.

3/ 250 KWH per sow.

4/ Estimated at $0.50 per hog marketed.

5/ Estimated at 0.8 per cent of building investment.

6/ Three per cent of value of breeding stock.

7/ Six per cent of average outlay for feed.

8/ Telephone, business expenses, etc.

3) Net Income (Initial Conventional)

i Net income of the basic enterprise.

Gross income	$9,880
Expenditure	9,213
Net income	667
Interest on capital (6%)	363
Labour income	304

ii Net income of the same enterprise in Nova Scotia.

Gross income 1/	$10,344
Expenditure 2/	9,548
Net income	796
Interest on capital (6%)	363
Labour income	433

iii Net income of the same enterprise in New Brunswick.

Gross income	$10,211
Expenditure	9,124
Net income	1,087
Interest on capital (6%)	363
Labour income	724

Weanling Enterprise (Initial)

1) Gross Income

Weanlings - 675 @ $14.50 $9,788 3/

The gross income of a weanling enterprise varies according to number, average weight and price of weanlings sold. In this analysis weanlings were assumed to average 40 pounds when sold. The price of weanlings varies according to average weight and current and expected prices for market hogs. The price of 30-pound

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1/ The higher gross income reflects the $1.00 per cwt. price differential and the Nova Scotia premium of $1.00 for Grade A hogs.

2/ The higher expenditure reflects higher feed and marketing costs in Nova Scotia relative to Prince Edward Island.

3/ Weanling price was based on a mainland market price of $30 per cwt. and a Prince Edward Island price of $29 per cwt. for Grade A hogs. The price of weanlings can ordinarily be estimated at one-half the market price per cwt. for Grade A hogs.

weanlings ranged from $10 to $14 per weanling in Nova Scotia over the 1961-65 period but was considerably higher in 1965 and 1966 reflecting the higher prices for market hogs. 1/ In the fall of 1966 one Nova Scotia hog feeder was using the following formula for calculating the price paid for weanlings:

First 20 pounds	@ $0.65 per lb.
Next 10 pounds	@ $0.40 per lb.
Additional pounds	@ $0.25 per lb.

Using this formula 40-pound weanlings would cost $19.50 each and 30-pound weanlings $17.00. Prices for market hogs at this time were in excess of $35 per cwt. The price paid for weanlings was between 30 and 35 per cent of the market value of hogs. A 1966 study of seven hog enterprises in Nova Scotia indicated an average price of $15.14 per weanling, or about 27 per cent of the average market value of $56.11 (including premiums). Weanlings purchased were, however, usually less than 40 pounds in weight. A thumb rule often used in establishing a price for weanlings is one-half the per cwt. price for Grade A hogs, i.e., when the price of hogs is $30 per cwt. the price of weanlings should be about $15.00.

2) <u>Expenditures</u>

<u>Feed</u> 2/

Sow ration 58.75T @ $80/T		$4,700
Pig starter 13.5T @ $115/T		1,552
	Total	$6,252

<u>Buildings and Equipment</u>

Depreciation	$14,800 @ 5%		$ 740
Repairs	$14,800 @ 1%		148
Insurance	$10/$1,000/3 yrs.		48
		Total	$ 936

1/ Hog Production in Nova Scotia, Nova Scotia Dept. of Agriculture and Marketing, 1966.

2/ Based on prices at Summerside, Prince Edward Island, July 1967.

Truck Operations 1/

Depreciation		$ 225
Repairs		90
Fuel and Oil		174
Licence and Insurance		90
	Total	$ 579

Livestock

Sow Depreciation (10% of value)		$ 338
Boar Depreciation ($35 per boar) 2/		70
	Total	$ 408

Other Costs

Veterinary and medical 3/		$ 270
Bedding 4/		-
Electricity 5/		126
Death loss in breeding stock 6/		107
Marketing costs 7/		-
Taxes 8/		57
Interest on operating capital 9/		188
Miscellaneous 10/		100
	Total	$ 848
Total Expenditures		$9,023

Cost per 40-pound weanling - $13.36

1/ Based on annual mileage of 5,000 miles.
2/ Estimated at $35 per boar per year. Boars were assumed to be purchased for $100, used for two years and then sold for $30.
3/ Estimated from Ontario, Alberta and Nova Scotia data at $6.00 per sow.
4/ Manure credits and bedding cost were assumed to cancel each other.
5/ Estimated at 175 KWH per sow per year.
6/ Three per cent of value of breeding stock.
7/ Operators of feeder enterprises were assumed to provide transportation, hence no marketing costs.
8/ Estimated as 0.8 per cent of average investment in buildings. The estimate was based on data from the 1961 Census.
9/ Six per cent of one-half of feed cost.
10/ Business expenses, telephone, etc.

3) Net Income (Initial Weanling)

i Net income of the basic enterprise.

Gross income	$ 9,788
Expenditure	9,023
Net income	765
Interest on capital (6%)	802
Labour income	-37

ii Net income of the same enterprise in Nova Scotia.

Gross income 1/	$10,125
Expenditure 2/	8,949
Net income	1,176
Interest on capital (6%)	802
Labour income	374

iii Net income of the same enterprise in New Brunswick.

Gross income	$10,125
Expenditure 3/	8,533
Net income	1,592
Interest on capital (6%)	802
Labour income	790

Feeder Enterprise (Initial)

1) Gross Income

Market hogs - 441 4/ @ 150 lbs. @ $28.60/cwt. 5/	$18,919
Grade A premium on 265 hogs	795
Total	$19,714

1/ The higher gross income reflects the higher price for market hogs in Nova Scotia and, hence, the higher price for weanlings.

2/ The slightly lower expenditure is the net effect of differences in feed costs and taxes.

3/ The lower expenditure reflects the effect, mainly, of lower feed prices in New Brunswick.

4/ A 2-per-cent death loss was assumed to occur between purchase and marketing. This estimate was based on Nova Scotia and Alberta data.

5/ Based on a price of $30 per cwt. for Grade A hogs in Moncton and marketing of 60 per cent A's and 40 per cent B's.

The gross income of a feeder enterprise varies according to the number of hogs marketed, the dressed weight of those hogs, location of the enterprise, prices, quality and time of marketing. The effects of some of these factors on gross income are as follows:

1. Change of one dollar per cwt. in the price of hogs	$ 660
2. Relocation of the enterprise in:	
- New Brunswick 1/	$ +660
- Nova Scotia 2/	$ +926
3. Marketing at 5 per cent above or below average price	$ 980
4. Change of one per cent in dressing percentage	$ 260

2) Expenditures

Feeder Pigs

450 weanlings @ $14.50	$6,525

Feed 3/

Hog grower 45T @ $77.80	$3,501
Hog finisher 92.25T @ $74.20/T	6,845
Total	$10,346

Buildings and Equipment 4/

Depreciation	$6,700 @ 5%	$ 335
Repairs	$6,700 @ 1.5%	100
Insurance	$10/$1,000/3 yrs.	22
	Total	$ 457

1/ Hog prices in Prince Edward Island were one dollar lower than in New Brunswick and Nova Scotia.

2/ The provincial premium of $1.00 for Grade A hogs was added to the federal premium in Nova Scotia.

3/ Feed prices basis Summerside, Prince Edward Island.

4/ Estimates were based on an assumed average useful life of buildings and equipment of 20 years.

Truck Operations 1/

5,000 miles @ 11.6¢/mile	$ 580

Other Costs

Veterinary and medical @ $0.50/hog 2/	$ 225
Transportation @ $0.50/hog marketed	220
Bedding 3/	-
Interest on operating capital 4/	281
Taxes 5/	25
Electricity 6/	155
Miscellaneous 7/	100
Total	$ 1,006

Total Expenditures	$18,914

Per hog marketed - $42.89 8/

1/ The cost estimate is based on operation of a pickup truck. Annual depreciation was estimated at 7.5 per cent and repairs at 3.0 per cent of replacement cost.

2/ Estimates ranged from $0.30 to $1.00 per hog.

3/ Bedding costs and manure credits are assumed to cancel each other.

4/ Six per cent of the average outlay for feed and feeders.

5/ The average tax rate in Prince Edward Island was 0.8 per cent of investment in land and buildings according to 1961 census data for commercial farms.

6/ 19 KWH per hog at $4.00 per month for the first 20 KWH, three cents per KWH for the next 180 KWH and the balance at two cents per KWH.

7/ Business expenses, telephone, etc.

8/ The cost per hog marketed compares with an average cost of $46.57 in a 1966 study of seven hog enterprises in Nova Scotia. The range in cost on these farms was from $43.92 per hog to $49.58 per hog.

The two most important cost items are feed and feeders. These two items together account for about 86 per cent of the total costs, hence changes in either or both of these factors changes substantially the cost and net income position of the enterprise. The effect of a number of factors on costs and net returns are indicated as follows:

1. Change of one dollar in weanling cost	$ 450
2. Change of one dollar per ton in feed cost	$ 137
3. Change of 25 pounds per hog in feed conversion	$ 415

3) Net Income (Initial Feeder)

i Net income of the basic enterprise.

Gross income	$19,714
Expenditure	18,914
Net income	800
Interest on capital (6%)	320
Labour income	480

ii Net income of the same enterprise in Nova Scotia.

Gross income	$20,640
Expenditure	19,864
Net income	776
Interest on capital (6%)	320
Labour income	456

iii Net income of the same enterprise in New Brunswick.

Gross income	$20,375
Expenditure	19,206
Net income	1,169
Interest on capital (6%)	320
Labour income	849

Budget Analysis of Optimum-Scale Hog Enterprises

In selecting optimum-scale hog enterprises particular attention was given to the problems associated with labour requirements in hog production. As with other livestock enterprises the labour and social objectives of optimum-scale enterprises are difficult to attain with one-man enterprises. The selection of suitable enterprises was made more difficult by the lack of pertinent data. Hog enterprises in the Maritime provinces are usually combined with other enterprises, and information on labour requirements of large-scale

specialized hog enterprises was not adequate. Current information from hog producers in the Maritimes and elsewhere suggests the following sizes of enterprises could be considered as two-man enterprises:

Conventional	-	100 sows
Weanling	-	200 sows
Feeder	-	1,500 feeders (3,750 hogs per year)

In the budget analyses these three sizes were chosen as bases for the optimum enterprises.

a) Basic Assumptions

1) Productivity - The analyses of conventional and weanling enterprises assume an output of 16 weanlings per sow per year. 1/ Feed inputs for market hogs are estimated at 610 pounds from weaning to market and 650 pounds from birth to market. 2/

2) Sources of Feed - All feeds are assumed to be purchased as prepared rations and delivered to the farm in bulk.

3) Mechanization - The estimates of capital and labour inputs assume bulk feed storage, mechanical feed distribution, automatic waterers and mechanical manure removal.

b) Input-Output Relationships

1) Feed Requirements - The feed inputs per hog were assumed to be the same as in the initial-stage enterprises. Total feed requirements for the three types of enterprises were estimated as follows:

1/ This assumed a weaning rate of 9.0 weanlings per litter per sow farrowed and a farrowing rate of 1.8 litters per sow per year.

2/ This estimate of feed requirements compares with an average feed input of 656 pounds per hog raised (weaning to market) and a range of 625 pounds to 709 pounds for a group of Nova Scotia feeder enterprises examined by the Economics Branch, Canada Dept. of Agriculture, Truro, in 1966.

Enterprise	Size	Sow Ration	Hog Grower	Hog Finisher	Pig Starter
		tons			
Conventional	100 sows	130	160	328	32
Weanling	200 sows	256	-	-	64
Feeder	3,750 hogs	-	375	769	-

2) Labour Requirements - The three hog enterprises were all assumed to be two-man enterprises. It is likely that two men could handle larger enterprises than those described above if they were viewed in terms of the direct labour inputs required for feeding, cleaning and other specific tasks. There are, however, the requirements for time off, holidays, etc. which limit the scale to that which can be operated by one man for short periods. In addition, there are occasional seasonal peaks in labour requirements that could preclude effective operation of larger enterprises by two men.

3) Capital Requirements - Capital requirements for hog enterprises were based on the following estimates of replacement costs:

Buildings	- farrowing unit	$ 330 per sow
	- feeder building	35 per hog
	- service building	1,000
	- housing (hired labour)	8,000
Equipment	- truck	6,000
	- manure pump and tank	2,000
	- well and pump	500
Livestock	- brood sows	75 each
	- boars	100 each

The total capital requirements for conventional, weanling and feeder enterprises were estimated as follows on the basis of replacement or new costs:

Enterprise	Size	Buildings	Equipment	Livestock	Total
	dollars				
Conventional	100 sows	60,000	8,500	7,800	76,300
Weanling	200 sows	75,000	5,500	15,500	96,000
Feeder	3,750 hogs	61,500	8,500	-	70,000

c) Enterprise Budgets

Conventional Enterprise (Optimum)

1) Gross Income 1/

Market hogs - 1,568 @ 150 lbs. dressed @ $28.60/cwt.	$67,267
Grade A premium - 941 hogs @ $3.00	2,823
Total	$70,090

2) Expenditures

Feed 2/

Sow ration - 130T @ $80.00/T	$10,400
Pig starter - 32T @ $115/T	3,680
Hog grower - 160T @ $77.80/T	12,448
Hog finisher - 328T @ $74.20/T	24,338
Total	$50,866

Buildings and Equipment 3/

Depreciation $62,500 @ 5%	$ 3,125
Repairs $62,500 @ 1.5%	938
Insurance	209
Total	$ 4,272

Truck Operation

5,000 miles @ 16.7¢/mile	$ 835

Livestock

Sow depreciation (10% of value)	$ 750
Boar depreciation 4/	105
Total	$ 855

1/ The estimate was based on the same price and quality assumptions used in the initial-stage budgets.

2/ Based on bulk, delivered prices from feed dealers in Prince Edward Island, 1967.

3/ Assumed a 20-year useful life for hog buildings and equipment.

4/ Estimated at $35 per boar per year.

Hired Labour

One man @ $300/month	$ 3,600

Other Costs

Veterinary and medicine @ $14/sow	$ 1,400
Electricity @ $50/month	600
Transportation	-
Taxes	265
Death loss in breeding stock (3%)	234
Interest on feed 1/	600
Miscellaneous 2/	350
Total	$ 3,449

Total Expenditures	$63,877

Per hog marketed - $40.73

Feed cost per hog marketed - $32.44

3) Net Income

i Net income of the basic enterprise.

Gross income	$70,090
Expenditure	63,877
Net income	6,213
Interest on capital (6%) 3/	2,728
Labour income	3,485

ii Net income of the same enterprise in Nova Scotia.

Gross income 4/	$73,383
Expenditure 5/	65,997
Net income	7,386
Interest on capital (6%)	2,728
Labour income	4,658

1/ Estimated at 6 per cent of the average outlay for feed.

2/ Includes telephone, business expenses, etc.

3/ Based on 6 per cent of average investment of $45,475. In a new enterprise interest on borrowed capital would likely be higher than the investment charge calculated.

4/ The higher gross income reflects the higher hog prices in Nova Scotia ($1.00 per cwt. higher than in Prince Edward Island) and the $1.00 per hog provincial premium on Grade A hogs in Nova Scotia.

5/ The higher expenditure reflects higher feed and marketing costs in Nova Scotia.

iii Net income of the same enterprise in New Brunswick.

Gross income 1/		$72,442
Expenditure		63,137
Net income		9,305
Interest on capital (6%)		2,728
Labour income		6,577

iv Net income of the same enterprise in Ontario.

Gross income 2/		$71,971
Expenditures: 3/		
Feed @ $24.50/hog	$38,416	
Other @ $8.30/hog	13,014	
Total Expenditures		51,430
Net income		20,541
Interest on capital (6%)		2,728
Labour income		17,813

v Net income of the same enterprise in western Canada.

Gross income 4/		$64,561
Expenditures: 5/		
Feed @ $20.50/hog	$32,144	
Other @ $8.30/hog	13,014	
Total Expenditures		45,158
Net income		19,403
Interest on capital (6%)		2,728
Labour income		16,675

1/ The higher gross income in New Brunswick relative to Prince Edward Island reflects the $1.00 per cwt. price differential between the two provinces.

2/ Based on the 1961-66 average price of $30.40 per cwt. for Grade A hogs at Toronto and marketing of 40 per cent A's and 60 per cent B's.

3/ The lower expenditures were due entirely to differences in feed costs between Ontario and the Maritimes.

4/ Based on the 1961-66 average price of $27.25 per cwt. for Grade A hogs at Edmonton and Saskatoon.

5/ The lower expenditures were due entirely to differences in feed costs between the Maritimes and western Canada. Feed costs were estimated from Alberta data at $20.50 per hog marketed as compared to $31 to $33 per hog marketed in the Maritimes.

Weanling Enterprise (Optimum)

1) Gross Income

Weanlings - 3,200 @ $14.50		$46,400

2) Expenditures

Feed

Sow ration - 256T @ $80/T		$20,480
Pig starter - 64T @ $115/T		7,360
	Total	$27,840

Buildings and Equipment

Depreciation $77,500 @ 5%		$ 3,875
Repair $77,500 @ 1.5%		1,162
Insurance		251
	Total	$ 5,288

Truck Operation

Pickup - 5,000 miles @ 10.5¢/mile		$ 525

Livestock

Sow depreciation		$ 1,500
Boar depreciation		175
	Total	$ 1,675

Hired Labour

One man @ $300/month		$ 3,600

Other Costs

Veterinary and medicine @ $6.00/sow		$ 1,200
Electricity @ $4.00/sow		800
Death loss in breeding stock (3%)		465
Interest on feed financing		218
Taxes		341
Marketing costs		-
Miscellaneous		350
	Total	$ 3,374
Total Expenditure		$42,302
Per weanling - $13.22		

3) Net Income

i Net income of the basic enterprise.

Gross income	$46,400
Expenditure	42,302
Net income	4,098
Interest on capital (6%)	3,600
Labour income	498

ii Net income of the same enterprise in Nova Scotia.

Gross income 1/	$48,000
Expenditure 2/	41,684
Net income	6,316
Interest on capital (6%)	3,600
Labour income	2,716

iii Net income of the same enterprise in New Brunswick.

Gross income 1/	$48,000
Expenditure 2/	40,393
Net income	7,607
Interest on capital (6%)	3,600
Labour income	4,007

iv Net income of the same enterprise in Ontario.

Gross income		$48,640
Expenditures:		
Feed @ $7.50/weanling	$24,000	
Other @ $4.50/weanling	14,400	
Total Expenditures		38,400
Net income		10,240
Interest on capital (6%)		3,600
Labour income		6,640

Feeder Enterprise (Optimum)

1) Gross Income

Market hogs 3/ - 3,675 @ 150 lbs. dressed @ $28.60/cwt.	$157,658
Grade A premium - 2,205 hogs @ $3/hog	6,615
Total	$164,273

1/ Based on a price of $15.00 per weanling as compared to $14.50 in Prince Edward Island. The higher price reflects the $1.00 per cwt. difference in market hog prices between Prince Edward Island and the mainland.
2/ The differences in expenditure among provinces reflect the differences in feed costs and taxes.
3/ Assumes a 2-per-cent death loss between weaning and marketing.

2) Expenditures

Feed

Hog grower - 375T @ $77.80/T	$ 29,175
Hog finisher - 769T @ $74.20/T	57,060
Total	$ 86,235

Feeders

Weanlings - 3,750 @ $14.50	$ 54,375

Buildings and Equipment

Depreciation $64,000 @ 5.0%	$ 3,200
Repair $64,000 @ 1.5%	960
Insurance	214
Total	$ 4,374

Truck Operation

5,000 miles @ 16.7¢/mile	$ 835

Hired Labour

One man @ $300/month	$ 3,600

Other Costs

Veterinary and medicine @ $0.50/hog	$ 1,875
Taxes	271
Electricity	600
Interest on feeders and feed	2,340
Miscellaneous	350
Total	$ 5,436

Total Expenditure	$154,855

Per hog marketed - $42.13

Feed cost per hog marketed - $23.46

3) Net Income

i Net income of the basic enterprise.

Gross income	$164,273
Expenditure	154,855
Net income	9,418
Interest on capital (6%)	2,310
Labour income	7,108

ii Net income of the same enterprise in Nova Scotia.

Gross income 1/	$171,990
Expenditure 2/	162,701
Net income	9,289
Interest on capital (6%)	2,310
Labour income	6,979

iii Net income of the same enterprise in New Brunswick.

Gross income 3/	$169,785
Expenditure 4/	156,806
Net income	12,979
Interest on capital (6%)	2,310
Labour income	10,669

iv Net income of the same enterprise in western Canada.

Gross income 5/	$151,318
Expenditure 6/	123,495
Net income	27,823
Interest on capital (6%)	2,310
Labour income	25,513

1/ Reflects the $1.00 per cwt. price spread between Prince Edward Island and Nova Scotia and the provincial premium of $1.00 per Grade A hog in Nova Scotia.

2/ Reflects higher feed, feeder and marketing costs, and higher taxes.

3/ Reflects the $1.00 per cwt. price spread between Prince Edward Island and New Brunswick.

4/ The difference in expenditure between Prince Edward Island and New Brunswick reflects differences in feed, feeder and marketing costs and taxes.

5/ Based on a price of $27.25 per cwt. and marketing of 40 per cent A's and 60 per cent B's.

6/ The lower expenditure in western Canada reflects lower feed costs ($15.00 per hog) and lower prices for weanlings than in the Maritimes.

v Net income of the same enterprise in Ontario.

Gross income 1/	$168,682
Expenditure 2/	142,545
Net income	26,137
Interest on capital (6%)	2,310
Labour income	23,827

Appraisal of Hog Enterprises

The budget analysis of hog enterprises was concerned with several sizes and types of specialized enterprises. Budgets were developed for two sizes each for conventional, weanling and feeder enterprises. The budgets for the smaller or initial-stage enterprises were based on conventional enterprises with 15 sows, weanling enterprises with 45 sows and feeder enterprises with 180 hogs (450 per year). The budgets for the larger optimum-scale enterprises were based on the following sizes: conventional, 100 sows; weanling, 200 sows; and feeder, 1500 hogs (3,750 per year). These were considered two-man enterprises. All of the budgets were based on purchased feeds. Interprovincial and interregional differences in the net incomes of these enterprises reflected differences in feed prices, hog prices, premiums, marketing costs and other factors.

The budget analyses indicated that large, efficient hog enterprises should be able to provide satisfactory levels of income for Maritime farmers at prices of $30 or more per cwt. for Grade A hogs. On the basis of price relationships and feed costs among provinces in mid-1967, enterprises in New Brunswick would appear to have a slight advantage over Nova Scotia and Prince Edward Island. The lower net income of hog enterprises in Prince Edward Island reflected the price differential of $1.00 per cwt. between the Island and the mainland provinces. This differential appeared to be related to transportation costs. Anticipated improvements in transportation should reduce this differential and improve the competitive position of hog production on the Island. Differences between New Brunswick and Nova Scotia were related, largely, to higher feed costs in Nova Scotia.

The most satisfactory measure of the profitability of hog production in the Maritimes was provided in the budget analysis of conventional enterprises. The relative profitability of weanling and feeder enterprises depends on the prices estimated for weanlings. Labour incomes in optimum-scale conventional enterprises in the Maritimes ranged from

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1/ Based on a price of $30.40 per cwt. for Grade A hogs and marketing of 40 per cent A's and 60 per cent B's.

2/ The lower expenditure in Ontario reflects lower feed costs ($18.50 per hog) than in the Maritimes.

about $3,500 in Prince Edward Island to about $6,600 in New Brunswick. These estimates assumed a mainland price of $30 per cwt. for Grade A hogs and marketings of 60 per cent Grade A's and 40 per cent Grade B's. Premiums on Grade A hogs were included in the estimates of gross income. These premiums ($3.00 per Grade A hog in New Brunswick and Prince Edward Island and $4.00 in Nova Scotia) represented over half of the labour income in the budgeted enterprises in Prince Edward Island and Nova Scotia and about 40 per cent in New Brunswick.

The budget analysis indicated that hog production is more profitable in western Canada and Ontario than in the Maritimes. Production costs in western Canada and Ontario were lower by a margin much greater than the cost of shipping pork to the Maritime region. The advantage was due mainly to lower feed costs in the other regions. Feed costs in the main hog areas in Alberta and Saskatchewan are about $20 per hog relative to $30 or more per hog in the Maritimes. The profitability of hog production in these other regions does not necessarily indicate that hog production will now be expanded there, driving down prices so Maritime hog producers can no longer obtain satisfactory incomes from hogs. Other enterprises - grain and in some cases, beef enterprises in western Canada, and fluid milk, beef-feeding and various cropping enterprises in Ontario - are more favourable than hog enterprises, in these other regions, in terms of profits, labour inputs and other factors. In other words, the comparative advantage in agriculture in these other regions is found to a large degree in enterprises other than hogs. It may even be possible for hog production in the Maritimes to be effectively expanded, provided the enterprises now favoured over hogs in other regions do not weaken unduly. There was some indication in late 1967, for example, that wheat prices and wheat exports could weaken significantly over the next several years and this could result in a major expansion of Prairie hog production.

Yet in livestock production in the Maritimes, hogs would appear to offer the best opportunity for expansion. Market limitations preclude significant increases in fluid milk and poultry production. Beef enterprises appear unable to compete with enterprises elsewhere. The prospects for manufacturing milk enterprises appear unfavourable. Hog production in the Maritimes is based to a considerable extent on imported feed grains. Since grain production in the Maritimes, with the exception of that produced as a rotation crop on potato farms, tends to be relatively costly, the potential for expansion in hog production is dependent on the cost of imported feeds. Any increase in grain prices, whether through the removal of freight subsidies or by some other means, would weaken the hog enterprise potential seriously. Without subsidies on grain imports it is likely that hog production in the Maritimes would decline to a level which could be

supported by the feed grains produced on potato farms and secondary grain enterprises on other types of farms. Moreover, other subsidies (including the federal and Nova Scotia premiums on Grade A hogs and transportation subsidies) contribute a substantial part of the net labour income shown in the budget analyses. It may be evident that enterprises heavily dependent on subsidies tend to be unstable in the long run.

In view of the difference between the prices which grain producers receive and those which hog producers pay for grain, there would appear to be some scope for combining these enterprises in the Maritimes, especially in Prince Edward Island. This possibility was examined by combining the grain enterprise and the optimum-scale conventional hog enterprise and substituting the grain produced in the grain enterprise for the purchased grain. The labour income of the operator in this combined operation worked out to $9,000, assuming labour and capital inputs equal to those in the specialized budgets and the same feed efficiency and quality of product from on-farm feed mixing as with commercially prepared feeds. The increased level of income reflects the difference between the buying and selling prices for grain. In practice the labour income of such an operation may be lower than indicated due to annual variability of grain output and some evidence that the physical productivity of the grain enterprise was overestimated in the grain budget. Nevertheless, this combined operation appears to have some potential where local supplies of grain can be produced with reasonable efficiency. The greatest potential for it would appear to be in the potato areas of New Brunswick and in Prince Edward Island. The profitability of this combination in past years in Prince Edward Island may be reflected in the higher level of hog output relative to the total requirements there than in Nova Scotia and New Brunswick. It may also indicate a somewhat higher level of profit in hog production there despite somewhat lower prices.

7. POULTRY ENTERPRISES

Commercial egg and poultry production in the Maritimes is highly specialized, generally well mechanized and compares favourably in terms of productivity, level of technology, feed conversion and the like with other regions. Within the Maritime region, commercial poultry enterprises are probably the most highly developed of all agricultural enterprises. The budget analyses of these enterprises attempted therefore to portray the profitability of selected sizes of existing enterprises.

Since Maritime poultry enterprises are generally as effectively developed as those in competing regions in terms of physical productivity the comparative analysis was concerned with the effect of differences in feed costs, prices and other economic factors on the profitability of these enterprises.

Budgets were developed for two sizes of egg and broiler enterprises. The initial-stage budgets were based on a 4,000-hen laying enterprise and a 5,000-bird (20,000 per year) broiler enterprise. Feed conversion ratios, output levels, labour efficiency, etc. in these enterprises were lower than in many of the existing enterprises in the Maritimes. The budgets for the larger enterprises were based on a 12,000-hen laying enterprise and a 30,000-bird (120,000 per year) broiler enterprise. These enterprises were considered to be sufficiently large to enable fulfillment of the labour and social objectives of optimum-scale enterprises. Many poultry enterprises in the Maritimes were already in this general size category.

Poultry production in the Maritimes is concentrated in a few areas. The areas of greatest concentration are the Annapolis Valley in Nova Scotia and the Fredericton and Moncton areas in New Brunswick. In Prince Edward Island, where there is only a small number of specialized laying operations and few, if any, commercial broiler operations, the degree of concentration is much lower. Broiler enterprises are, in general, located relatively close to processing plants. Laying enterprises are less concentrated, geographically, than broiler enterprises and many of them are located near the major population centres and market their produce mainly in the local markets. Many of these enterprises grade, package and deliver their own eggs to retail outlets. The budget analyses assumed, initially, that poultry enterprises were located in the Moncton area. The effects of locating these enterprises elsewhere were indicated through differences in net incomes which reflected, primarily, inter-area differences in prices, feed costs and taxes.

Background Information

The trend in the number of hens and chickens in the Maritimes has been generally upward over the past 25 years. The total number of hens and chickens increased about 50 per cent over that period and reached 4.5 million in 1966 (Table 7-1). Decreases in Prince Edward Island have been more than offset by substantial increases in poultry numbers in Nova Scotia. Poultry numbers in New Brunswick remained relatively constant over the 1941-1965 period, but with some increase in 1966. The trends in poultry numbers in the three provinces are reflected in the output of eggs and poultry meat. In Prince Edward Island both egg and meat production has been declining. In Nova Scotia and New Brunswick egg production has been relatively stable over the past few years but poultry meat production has expanded rapidly, especially in Nova Scotia (Tables 7-2 and 7-3). Production data suggest that the recent increases in poultry numbers in Nova Scotia and New Brunswick have been largely for meat production.

Poultry enterprises are important sources of farm income in the Maritimes, particularly in Nova Scotia. In the 1961-66 period, egg and poultry sales accounted for almost one-quarter of farm cash receipts in that province (Table 7-4). The proportions were much lower in the other two provinces - less than 5 per cent (and declining) in Prince Edward Island, and about 11.5 per cent in New Brunswick.

TABLE 7-1

Hens and Chickens on Farms, Maritimes, Selected Years

Year	P.E.I.	N.S.	N.B.	Maritimes
	----------	thousands	----------	----------
1941	807	1,113	1,102	3,022
1951	978	1,630	1,230	3,838
1956	812	1,908	1,124	3,844
1961	509	2,185	1,040	3,734
1962	440	2,015	1,070	3,525
1963	435	2,250	1,050	3,735
1964	445	2,110	1,070	3,625
1965	435	2,210	1,150	3,795
1966	352	2,801	1,339	4,492

Source: Census of Canada, Agriculture, 1961 and 1966, and D.B.S. Quarterly Bulletin of Agricultural Statistics.

TABLE 7-2

Egg Production, Maritimes,

Selected Years

Year	P.E.I.	N.S.	N.B.
	--------- thousand dozen -------		
1954-58 (Av.)	6,233	17,182	8,504
1959-63 (Av.)	4,446	18,779	8,654
1964	4,079	18,278	9,713
1965	3,944	18,450	9,189
1966	3,388	18,854	8,680

Source: Canadian Farm Economics, Vol. 1, No. 6, Economics Branch, Canada Dept. of Agriculture, 1967; and Quarterly Bulletin of Agricultural Statistics.

TABLE 7-3

Production of Fowl and Chicken, Maritimes,

Selected Years

Year	P.E.I.	N.S.	N.B.
	-------- thousand pounds -------		
1954-58 (Av.)	2,868	7,911	5,878
1959-63 (Av.)	1,563	12,533	5,211
1964	898	15,505	5,420
1965	1,048	15,078	7,406
1966	1,021	18,849	9,593

Source: Canadian Farm Economics, Vol. 1, No. 6, Economics Branch, Canada Dept. of Agriculture, 1967; and Quarterly Bulletin of Agricultural Statistics.

TABLE 7-4

Proportion of Farm Cash Receipts from Eggs and Poultry, Maritimes, Selected Years

Year	Eggs			Poultry		
	P.E.I.	N.S.	N.B.	P.E.I.	N.S.	N.B.
	per cent					
1940	6.9	5.2	3.8	4.2	1.9	2.0
1950	7.0	10.2	4.7	4.4	5.2	4.2
1960	5.5	18.4	5.7	2.2	7.8	3.2
1961	5.0	16.5	7.7	2.1	8.2	3.9
1962	4.8	15.2	8.2	1.7	8.7	3.3
1963	5.4	15.8	9.5	1.3	9.6	3.9
1964	3.7	13.5	7.5	0.9	9.7	3.2
1965	2.9	14.0	6.1	0.7	9.0	3.8
1966	3.4	15.0	7.2	0.8	9.9	5.8

Source: Farm Cash Income, D.B.S.

Most poultry enterprises in the Maritimes are very small (Table 7-5). Data which describe the average size of poultry enterprise are not, however, suitable indicators of the scale of commercial poultry enterprises since they include a large number of farm flocks which are kept mainly for home use purposes. Commercial poultry production in the Maritimes, as elsewhere, has become highly specialized, and the bulk of egg and poultry products is produced by a relatively small number of large enterprises. 1/ Specialization in poultry production is much further advanced in Nova Scotia than in the other Maritime provinces. In 1961, the average enterprise on farms classified as poultry farms had over 4,000 birds in Nova Scotia as compared to about 2,200 birds in the other two provinces. A further indication of the degree of specialization was that in 1961,75 per cent of all hens and chickens in Nova Scotia were on farms defined as poultry farms as compared to 57 per cent in New Brunswick and 21 per cent in Prince Edward Island. The trend toward specialization has apparently continued since 1961. For example, in Kings county, Nova Scotia, where poultry production is most highly concentrated, the average size of poultry enterprise increased from 2,317 birds in 1961 to 4,850 birds in 1966.

1/ For example, in Nova Scotia in 1961, two-thirds of the egg and poultry sales of commercial farms were made by farms with product sales in excess of $25,000.

TABLE 7-5

Average Numbers of Hens and Chickens in Poultry Enterprises in Various Categories of Maritime Farms, 1961

Class of Farm	P.E.I.	N.S.	N.B.
	-------------	number	------------
All census farms	120	370	150
Commercial farms	162	807	279
Poultry farms*	2,188	4,076	2,288
Upper 20 per cent‡	454	1,154	580
Upper 10 per cent	615	2,141	1,036
Upper 5 per cent	1,049	3,632	1,796
Farms with over $25,000 in product sales#	2,550	12,100	4,340
Per cent of birds on poultry farms	21%	75%	57%

* Farms receiving over half their gross income from the sale of eggs and poultry meat.

‡ Number of hens and chickens on the 20 per cent of farms reporting the largest enterprises.

\# Number of hens and chickens in poultry enterprises on farms in the $25,000-plus product-sales category.

Source: Census of Canada, Agriculture, 1961.

This trend toward specialization is also indicated by the rapid decline in the proportion of farms with poultry (Table 7-6). This decline has been even more rapid than the decline in the total number of farms. By 1966, the number of poultry enterprises in the Maritimes had declined to slightly more than half the number in 1961, and to about one-quarter the number in 1951.

TABLE 7-6

Proportion of Farms in the Maritimes

With Poultry, Selected Years

Year	P.E.I.	N.S.	N.B.
	----------- per cent --------		
1951	79.5	60.2	67.3
1956	73.0	54.2	62.1
1961	57.7	47.2	59.0
1966	40.6	33.8	43.6

Source: Census of Canada, Agriculture, 1961 and 1966.

Budget Analysis of Initial-Stage Poultry Enterprises

The budgets for the initial-stage enterprises were based on a 4,000-hen laying enterprise and a 5,000-bird (20,000 per year) broiler enterprise. The selection of these sizes of enterprises was, to a large extent, arbitrary. Census data for poultry are not sufficiently detailed in terms of enterprise separation and size distributions to provide a more precise basis for enterprise selection. Furthermore, the changes in the average sizes of enterprises (due mainly to the disappearance of many small enterprises) have been so rapid in recent years that 1961 data were no longer good indicators of the sizes of poultry enterprises.

The budget for the 4,000-hen laying enterprise was based on average production levels, relatively low levels of mechanization and higher labour inputs than many of the existing enterprises. Eggs were assumed to be delivered to grading stations. In the initial-stage broiler enterprise, feed conversion ratios, labour inputs and mortality rates were higher than in many operating enterprises. For clarity, the remainder of the initial-stage budget analysis is divided into two parts - Part 1, Laying Enterprise and Part 2, Broiler Enterprise.

Part 1 - Laying Enterprise (Initial)

a) Basic Assumptions

1) Productivity - Estimates of feed requirements and egg output were based on a productivity level of 18 dozen eggs per layer and a feed conversion ratio of five pounds of feed per dozen eggs. Replacement birds were assumed to be raised on the farm. This practice is

common among small enterprises but the trend in larger enterprises is toward purchase of 20 to 22 week old pullets which go directly into the laying house. In these larger enterprises the raising of replacement chicks would create a seasonal peak in labour requirements.

2) Sources of Feed - All feeds were assumed to be purchased as prepared rations and delivered to the farm in bulk.

3) Mechanization - The analysis assumed conventional housing, bulk feed storage and manual feedings, cleaning and egg-gathering.

4) Mortality - Chick mortality was estimated at 10 per cent and laying-hen mortality at 12 per cent.

b) Input-Output Relationships

1) Feed Requirements - The feed requirements for the 4,000-hen laying enterprise were based on the numbers of birds required at each stage. The numbers of birds in the various age groups reflect the above estimates of mortality. Number of birds in a 4,000-hen laying enterprise:

Chicks purchased 1/	4,625
Pullets	4,250
Layers (av. no.)	4,000
Cull hens	3,745

It was assumed that most of the chick mortality occurred in the first few days and that hen mortality was evenly distributed, hence estimates of feed requirements were based on the number of pullets raised and on the average number of layers in production.

Feed requirements for a 4,000-hen laying enterprise:

	Birds on Feed	Feed Input Per Bird	Total Feed Required
	(number)	(pounds)	(tons)
Pullets			
Starter	4,250	2.5	5.3
Grower	4,250	17.5	37.2
Layers			
Laying mash	4,000	90.0	180.0

1/ Two-per-cent extras supplied by the hatchery were not included.

2) Labour Requirements - The labour requirements of laying enterprises vary with:

1. The size of enterprise

2. The production methods used

   - conventional vs. caged housing
   - manual vs. mechanical feeding
   - manual vs. mechanical egg-gathering

3. The amount of the marketing function undertaken

   - delivery to a grading station
   - on-farm washing, grading and packing, and delivery to a retail outlet
   - selling direct to consumers.

Estimates of labour requirements which follow were obtained from an enterprise study in which many of the enterprises were similar to the one used in this analysis. 1/ The total labour requirements per layer ranged from about one hour per bird for enterprises selling to grading stations to 1.5 hours per bird for enterprises selling directly to consumers.

Labour requirements of laying enterprises:

Pullets	.15 hours per layer
Hens	.50 hours per layer
Marketing eggs	
- to retailers 2/	.50 hours per layer
- to grading stations 3/	.33 hours per layer
- to consumers 4/	.88 hours per layer

Total labour requirements per hen:

Eggs sold to retailers	1.15 hours
Eggs sold to grading stations	0.98 hours
Eggs sold directly to consumers	1.53 hours

1/ G.R. Keay, The Economics of Producing and Marketing Table Eggs, Alberta Dept. of Agriculture, Edmonton, 1966.

2/ Included washing, grading, packing in cartons and delivery to retail outlets.

3/ Included cleaning, packing in flats and delivery to grading stations.

4/ Included washing, grading, packing and delivery to consumers.

3) Capital Requirements - Capital requirements for a laying enterprise vary according to size of enterprise, type of housing, method of obtaining replacements and marketing method. The estimates of capital requirements which follow assumed conventional housing, raising of replacements and delivery of eggs to grading stations.

Buildings and Equipment (Replacement Cost)

Laying house 4,000 layers @ $3.50/layer	$14,000
Brooder 4,250 pullets @ $2.00/pullet	8,500
Water system (well and pump)	500
Truck (pickup)	3,000
Total	$26,000

c) Enterprise Budget

1) Gross Income

Eggs

4,000 hens @ 18 doz./hen @ $0.38/doz.	$27,360

Cull birds

3,745 hens @ $0.20	750
	$28,110

The estimate of receipts from eggs was based on the 1960-66 weighted average price paid to producers at registered grading stations in New Brunswick (Table 7-7). The average price was higher in New Brunswick during this period than in either Nova Scotia or Prince Edward Island. Over the 1960-66 period, prices for ungraded eggs averaged 30.9, 34.2 and 38.0 cents per dozen in Prince Edward Island, Nova Scotia, and New Brunswick, respectively. These grading station price differentials were not paralleled in the prices paid by retailers for graded eggs. In fact, in 1966 and 1967 prices paid by retailers for graded eggs were higher in Prince Edward Island than in Nova Scotia and New Brunswick.

2) Expenditures

Chicks

4,625 chicks @ $0.43	$1,989

TABLE 7-7

Weighted Average Egg Prices to Producers at Registered Grading Stations, Selected Provinces, 1960-66

Year	P.E.I.	N.S.	N.B.	Québec	Ontario
	------	------	cents per dozen	------	------
1960	28.1	33.5	35.6	33.1	31.2
1961	29.4	34.2	37.8	33.8	32.9
1962	29.5	32.2	35.4	30.7	31.0
1963	33.0	35.2	38.4	35.2	35.3
1964	27.6	29.2	33.2	27.3	26.9
1965	30.4	33.3	40.0	32.8	21.5
1966	38.2	41.5	45.8	42.8	41.4
Average 1960-66	30.9	34.2	38.0	33.7	32.9

Source: Poultry Market Review, Canada Dept. of Agriculture, Ottawa.

Feed 1/

Starter 5.3T @ $112/T		$ 594
Grower 37.2T @ $83/T		3,080
Laying mash 180T @ $88/T		15,840
	Total	$19,514

Buildings and Equipment 2/

Depreciation $23,000 @ 6%		$ 1,380
Repairs $23,000 @ 1%		230
Insurance $23,000 @ 2%		460
	Total	$ 2,070

Truck 3/

Annual use 10,000 miles @ 8.3¢/mile — $ 830

1/ Feed costs were based on bulk prices at Moncton, May, 1967.

2/ Building costs assumed a normal lifetime of 15 years and a 10-per-cent salvage value.

3/ Based on 10,000 miles per year, 15 miles per gallon and fuel prices of 49.8 cents per gallon.

Other Costs

Medicine @ $4/100 birds		$ 160
Taxes @ 1.5% of building investment		169
Brooding (fuel) @ 1¢/bird		42
Electricity @ 1¢/doz.		720
Interest on birds (6%)		119
Supplies @ $0.10/layer		400
Miscellaneous		200
	Total	$ 1,810

Total Expenditures	$26,213
Per dozen - 36.4¢	
Per layer - $6.55	

3) Net Income

i Net income of the basic enterprise.

Gross income	$28,110
Expenditure	26,213
Net income	1,897
Interest on capital (6%)	790
Labour income	1,107

ii Net income of the same enterprise in Nova Scotia.

Gross income 1/	$25,374
Expenditure 2/	26,818
Net income	-1,444

iii Net income of the same enterprise in Prince Edward Island.

Gross income 3/	$22,248
Expenditure 4/	26,818
Net income	-4,570

1/ Based on a price of 34.2¢ per dozen for eggs delivered to grading stations. (See Table 7-7.)

2/ The higher expenditure was due, mainly, to higher feed prices.

3/ Based on a price of 30.9¢ per dozen for eggs delivered to grading stations. (See Table 7-7.)

4/ The higher expenditure was due, mainly, to slightly higher prices for prepared poultry feeds.

Part 2 - Broiler Enterprise (Initial)

a) Basic Assumptions

1) Productivity - The broiler analysis was based on production of four 5,000-bird lots per year on a feed conversion ratio of 2.5 pounds of feed per pound of live bird. Market weight was estimated at 4.0 pounds, live.

2) Mortality - Mortality was estimated at 4 per cent including the extra birds (3 per cent) provided by the hatchery.

3) Sources of Feed - All feeds were assumed to be purchased as prepared rations and delivered to the farm.

4) Capital Requirements - Estimates obtained in the Maritimes and in Ontario suggested a replacement cost of about $3.00 per bird capacity for buildings and equipment for small-scale broiler enterprises.

b) Enterprise Budget

1) Gross Income

Broilers - 19,800 birds 1/
@ 4.0 lbs. @ 21.0¢/lb. $16,632

The gross income of broiler enterprises varies with the scale of enterprise, weight of birds and broiler prices. Enterprise size was established at 20,000 birds per year and average weight was assumed to be 4.0 pounds. Gross income for a 5,000-bird enterprise over a range of prices was estimated as follows:

Price (¢/lb.)	Gross Income
18	$14,256
19	15,048
20	15,840
21	16,632
22	17,424
23	18,216

1/ Four lots per year less a 1-per-cent death loss, i.e., 19,800 birds marketed per year. The price estimate used corresponds to the price paid in October, 1967, for broilers in New Brunswick.

2) Expenditures

Chicks 20,000 @ 14.5¢ 1/	$ 2,900
Feed 100T @ $113.50/T 2/	11,350
Brooding (fuel) @ 2¢/bird	400
Litter @ $2/1,000 birds 3/	40
Electricity @ 1¢/bird 3/	200
Taxes @ 1.5% of average building investment	112
Depreciation $15,000 @ 6% 4/	900
Repairs $15,000 @ 1%	150
Insurance $15,000 @ 0.5%	75
Interest on feed and birds 5/	129
Transport 6/	-
Cleaning supplies, disinfectants @ 5¢/bird 7/	100
Total Expenditures	$16,356

Per bird 81.8¢
Per pound (live weight) 20.4¢

Main elements in the cost of broiler production are chicks and feed. Feed represents about 71 per cent and chicks about 19 per cent of production costs. Since feed is the largest single cost item the profitability of broiler production is highly dependent on feed efficiency or feed conversion. A feed conversion ratio of 2.5:1 was used in the budget calculations. Feed conversion ratios range from as low as 2.1:1 in efficient enterprises to upwards of 3:1. Conversion ratios of less than 2.0:1 have been achieved with broilers marketed at lighter weights. The effects of the feed conversion ratio on costs and net income in a 5,000-bird enterprise are indicated in Table 7-8 for the initial-stage broiler enterprise.

1/ Based on data from a New Brunswick hatchery.
2/ Based on bulk feed prices at Moncton, 1967.
3/ Based on data from Nova Scotia and New Brunswick producers and from Broiler Cost Comparisons, (unpublished), Poultry Branch, Alberta Dept. of Agriculture, Edmonton.
4/ Assumed an average life of 15 years for buildings and equipment and a salvage value of 10 per cent of new cost.
5/ Six per cent of the average outlay for feed and chicks for one lot.
6/ No transport costs because bird costs, feed costs, and market prices are at on-farm prices.
7/ Based on data from Ontario broiler producers.

TABLE 7-8

Effect of Feed Conversion on Cost and Net Income in 5,000-Bird Broiler Enterprise*

Feed Conversion Ratio‡	Feed Cost	Total Cost	Change in Cost and Net Income#
	-------- dollars	---------------	
2.0	9,080	14,086	2,270
2.1	9,534	14,540	1,816
2.2	9,988	14,994	1,362
2.3	10,442	15,448	908
2.4	10,896	15,902	454
2.5	11,350	16,356	-
2.6	11,804	16,810	-454
2.7	12,258	17,264	-908
2.8	12,712	17,718	-1,362

* The calculations are based on production of 20,000 broilers per year. Other costs are assumed to remain the same as those indicated in the expense breakdowns in the text.

‡ Pounds of feed per pound of live-weight gain.

\# The positive and negative figures refer to changes in net income from the base conversion ratio of 2.5:1.

3) Net Income

i Net income of the basic enterprise.

Gross income	$16,632
Expenditure	16,356
Net income	276
Interest on capital (6%)	450
Labour income	-174

ii Net income of the same enterprise at alternative prices.

Price Level	Gross Income	Net Income	Labour Income 1/
¢/lb.	-----------	dollars	------------
18	14,256	-2,100	-2,550
19	15,058	-1,298	-1,748
20	15,840	-516	-966
21	16,632	276	-174
22	17,424	1,068	618
23	18,216	1,860	1,410

iii Net income of the same enterprise in Nova Scotia.

Gross income 2/	$16,236
Expenditure 3/	15,854
Net income	382
Interest on capital (6%)	450
Labour income	-68

Budget Analysis of Optimum-Scale Poultry Enterprises

Criteria for optimum-scale enterprises included specified levels of income, social amenities and labour requirements. In poultry enterprises, as with livestock enterprises, the nature of the labour requirement restricted access to social amenities. This limitation is particularly acute in small, one-man enterprises. To achieve the labour and social objectives established for optimum-scale enterprises, poultry enterprises should be large enough to employ two or more men. These enterprises should be large enough to provide full employment for the labour force yet sufficiently mechanized to allow the essential tasks to be performed by less than the total labour force.

Poultrymen in the Maritimes and Ontario suggested that with semi-automatic cages (mechanical feeding, watering and cleaning and manual egg-gathering) one man could operate a 12,000-bird laying enterprise. Some part-time help is usually required for gathering and packing eggs. To smooth this labour requirement many enterprises of this scale employ an extra man and add grading equipment to their operation.

1/ Assumed an investment charge of 6 per cent of average investment of $7,500.

2/ Based on the Nova Scotia price in October, 1967, of 20.5 cents per pound.

3/ The lower expenditure reflects lower prices for broiler feeds in Nova Scotia.

Part-time female help is usually added to assist in grading, washing and packing eggs. In most cases this part-time labour is readily available in the local area.

In broiler production it is possible for one man to operate and manage a 30,000-bird enterprise. Labour inputs in terms of feeding, cleaning and other specific tasks are not excessive in mechanized enterprises. There is, however, a very large time-input involved in maintaining the proper environment for broilers. This is a very critical element in feed efficiency and bird mortality and requires almost constant vigilance. As a result access to ordinary social amenities may be severely restricted in one-man enterprises, except during the period between lots. To fulfill the labour and social objectives of optimum scale, broiler enterprises should be large enough to employ more than one man. A suitable scale of enterprise would be one which permits the operator to perform all of the major tasks associated with the operation and management of the enterprise while leaving at least part of the "watchman" task to a hired man. This kind of arrangement is now employed by some broiler producers with 30,000-bird enterprises. The remainder of the analysis of the optimum enterprises is again divided into two parts - Part 1, Laying Enterprise and Part 2, Broiler Enterprise.

Part 1 - Laying Enterprise

a) Basic Assumptions

1) Productivity - Egg output was estimated at 20 dozen per bird housed or 21.2 dozen per average layer. The latter figure takes into account bird mortality of 1 per cent per month, and corresponds to an average production level of 70 per cent. Distribution by grades was estimated as follows: Grade A Large and Extra Large, 65 per cent; Grade A Medium, 25 per cent; Grade A Small, 6 per cent; and others, 4 per cent. 1/

2) Feed Conversion - Feed input was estimated at 4.5 pounds per dozen eggs, i.e., 90 pounds per bird housed.

3) Mechanization - The estimates of capital and labour requirements were based on an operation with caged layers, mechanical feeding and cleaning, manual egg-gathering and on-farm washing, grading and packing.

4) Mortality - Average mortality in laying flocks was estimated at 1 per cent per month.

1/ The grade distribution was based on data from registered grading stations.

b) <u>Input-Output Relationships</u>

1) <u>Feed Requirements</u> - The estimates of feed requirements for the optimum-scale laying enterprise were based on the above estimates of feed conversion, egg output, number of birds and mortality. Birds were assumed to be purchased as 20- to 24-week pullets which are placed directly in the cages. The feed requirements for a 12,000-hen layer enterprise were estimated at 540 tons.

2) <u>Labour Requirements</u> - The labour to service flocks and gather eggs varies by size of enterprise, feeding system, type of housing and egg-gathering system. In an Alberta study the labour requirements per layer for feeding, watering, removing litter, gathering eggs, etc., for the laying flock (excluding replacements) averaged 50 minutes per layer in small flocks (500 to 1,200 birds) and 24 minutes per layer in larger flocks (2,800 to 8,200 birds). 1/ Labour requirements for egg marketing in enterprises which sold to retail outlets averaged about 35 minutes per layer for a total labour input of about one hour per bird for the complete operation. In larger, more highly mechanized enterprises the labour input per bird is somewhat lower. A 12,000-bird enterprise selling graded eggs can be operated by two men with some part-time help for grading and packing eggs. The labour force for such an enterprise is commonly comprised of the operator, a hired man and part-time female help for packing and grading.

3) <u>Capital Requirements</u> - The capital requirement of a laying enterprise varies according to the size of the enterprise, the type of housing, the method of feeding, the egg-gathering system and the marketing system. The estimate of capital requirements for the 12,000-bird enterprise was based on the following assumptions:

1. Cage housing.
2. Purchased replacements (20 to 24 weeks).
3. Mechanical feeding, watering and cleaning.
4. Manual egg-gathering.
5. Grading, packing and delivery to a retail outlet.

Capital requirements for this enterprise were estimated as follows:

1/ G.R. Keay, *op. cit.*

Buildings and Equipment 1/	$36,000
Truck	3,000
Egg Cooler and Grading Equipment 2/	15,000
Total	$54,000

c) Enterprise Budget

1) Gross Income 3/

Eggs - 240,000 dozen distributed as follows:

Grade A Large	- 156,000 doz.@52.7¢/doz.		$82,212
Grade A Medium	- 60,000 doz.@46.2¢/doz.		27,720
Grade A Small	- 14,400 doz.@39.2¢/doz.		5,429
Others 4/	- 9,600 doz.		-
Cull Birds	- 10,650 @ 20¢/bird		2,130
		Total	$117,491

1/ Includes building, feed storage, cages, feeding equipment and manure disposal equipment.

2/ Based on information from a newly established enterprise in New Brunswick.

3/ Estimate of gross income was based on average prices paid for graded eggs sold to retailers in Halifax in 1962-66 (Table 7-9). These prices are adjusted slightly to reflect the price spread between markets. In 1966 the average price for Grade A Large eggs was one cent per dozen higher in Moncton and two cents per dozen higher in Charlottetown than in Halifax.

4/ The remaining 4 per cent were assumed to have no sale value in such enterprises. These eggs include cracks, soft shell eggs and other low quality eggs.

2) Expenditures

Feed 1/

Laying mash 540T @ $88/T	$47,520

Replacement Birds 2/

Pullets - 12,000 @ $2.30	$27,600

Buildings and Equipment 3/

Depreciation	$51,000 @ 6.0%		$ 3,060
Repair	$51,000 @ 3.0%		1,530
Insurance			667
		Total	$ 5,257

Truck

15,000 miles @ 10.3¢/mile	$ 1,545

Hired Labour 4/

Regular man @ $300/month		$ 3,600
Part-time help 3,000 hrs. @ $1/hr.		3,000
	Total	$ 6,600

1/ Based on bulk delivered prices at Moncton, 1967.

2/ Based on data from producers in New Brunswick. Price quotations range from about $2.00 to $2.50 per 20- to 24-week pullet.

3/ Based on an estimated useful life of 15 years and salvage value of 10 per cent of replacement cost. The rapid rate of technological change in poultry production would likely result in obsolescence of buildings and equipment regardless of their condition at that time.

4/ This estimate of hired labour cost approximates an estimate of $0.50 per bird obtained from a producer in the Maritimes with a similar enterprise. Many enterprises of similar size and organization have a larger labour force than the one indicated here.

TABLE 7-9

Prices Paid by Retailers for Grade A Large Eggs

In Cartons in Halifax, Montreal and Toronto, 1962-66

Year	Halifax	Montreal	Toronto
	------------ cents per dozen ------------		
1962	50.8	47.8	46.8
1963	52.5	52.8	51.8
1964	46.5	44.1	44.0
1965	50.3	48.5	47.6
1966	58.6	58.0	58.2
Average 1962-66	51.7	50.2	49.7

Source: Poultry Market Report, Canada Dept. of Agriculture, Ottawa. In Maritime markets the average price spreads were about 6.5 cents per dozen between Grade A Large and Grade A Medium and 15.0 cents per dozen between Grade A Large and Grade A Small.

Other Costs

Electricity @ 1¢/doz.	$ 2,400
Taxes @ 1.5% of building investment	450
Medicine @ $4/100 birds	480
Cartons @ 3.8¢/doz.	8,755
Supplies @ 20¢/bird	2,400
Interest on birds (7%) 1/	1,932
Miscellaneous 2/	350
Total	$ 16,767

Total Expenditures $105,289

Per layer housed - $8.77

Per dozen eggs - 43.9¢

Feed cost per dozen - 19.8¢

1/ Based on 7 per cent of bird cost, but in many cases the rate is 9 per cent or even higher.

2/ Includes telephone, business expenses, etc.

3) <u>Net Income - Laying Enterprise (Optimum)</u>

i Net income of the basic enterprise.

Gross income	$117,491
Expenditure	105,289
Net income	12,202
Interest on capital (6%) 1/	1,780
Labour income	10,422

ii Net income of the same enterprise in Nova Scotia.

Gross income 2/	$115,187
Expenditure 3/	106,220
Net income	8,967
Interest on capital (6%) 1/	1,780
Labour income	7,187

iii Net income of the same enterprise in Prince Edward Island. 4/

Gross income 2/	$119,795
Expenditure 3/	106,375
Net income	13,420
Interest on capital (6%) 1/	1,780
Labour income	11,640

1/ Interest on capital was calculated at 6 per cent of average investment where average investment was assumed to be 55 per cent of replacement cost. An enterprise in a low equity position would have debt charges higher than this since interest payments of 5 per cent or more are based on the new cost of the buildings and not on the average investment.

2/ The differences in gross income reflect price spreads among the Maritime provinces. Prices in Nova Scotia were estimated at one cent per dozen lower than in New Brunswick. Prices in Prince Edward Island were estimated at one cent per dozen higher than in New Brunswick.

3/ The differences in expenditure among provinces are, mainly, reflections of differences in feed costs.

4/ This estimate was based on existing price relationships in late 1967 between Halifax and Charlottetown. The higher price in Charlottetown no doubt represents a temporary differential and probably reflects a temporary shortage of high quality eggs in Prince Edward Island. An increase in the number of large-scale enterprises (10,000 birds or more) in Prince Edward Island would likely depress prices paid by retailers for graded eggs.

iv Net income of the same enterprise in Prince Edward Island on the basis of prices comparable to Halifax.1/

Gross income	$115,187
Expenditure	106,375
Net income	8,812
Interest on capital (6%)	1,780
Labour income	7,032

v Net income of the same enterprise in Ontario.

Gross income	$112,500
Expenditure	100,750
Net income	11,750
Interest on capital (6%)	1,780
Labour income	9,970

Part 2 - Broiler Enterprise

a) Basic Assumptions

1) Productivity - The analysis is based on production of 4.0-pound birds in 10 weeks with a feed input of 2.2 pounds per pound of live bird.

2) Mortality - It was assumed that the extra birds provided by the hatchery (3 per cent) die before reaching market weight.

3) Mechanization - Estimates of labour and capital inputs assumed mechanized feeding, bulk feed storage and other labour-saving equipment.

b) Input-Output Relationships

1) Feed Requirements - The estimate of feed requirements was based on the production of 120,000 broilers per year (four lots of 30,000 birds) at a feed conversion ratio of 2.2:1, i.e., 8.8 pounds of feed per bird. On this basis feed requirements were estimated at 528 tons per year.

2) Labour Requirements - Information from broiler producers indicated that one man could handle 20,000 to 30,000 broilers. A 20,000-bird enterprise was considered a minimum for feed, capital and labour efficiency. While enterprises of this size can be operated by one man they often have an extra man who performs caretaker duties in the absence of the operator, thereby providing the operator with access to some social amenities.

1/ Evidence indicated that egg prices in 1967 in Prince Edward Island were temporarily higher than normal.

3) Capital Requirements - The capital requirements of a broiler enterprise vary according to size of enterprise, type of construction and degree of mechanization. Estimates of building costs for enterprises of the size considered here usually range between $2 and $3 per bird. In this analysis it was assumed that adequate buildings and equipment can be provided at $2.50 per bird capacity. This estimate is $0.50 per bird lower than for the initial-stage enterprise. The estimated capital requirement for a 30,000-bird broiler enterprise is $75,000.

The rapid rate of technological change in broiler production results in buildings and equipment becoming obsolete in a short period of time. A period of 15 years was assumed to be the maximum over which the capital cost of buildings and equipment can be charged.

c) Enterprise Budget

1) Gross Income 1/

Broilers - 120,000 @ 4.0 lbs. @ 21¢/lb.	$100,800

2) Expenditures

Chicks 2/- 120,000 @ 14.5¢	$ 17,400
Feed 3/	
120,000 birds @8.8 lbs./bird @$113.50/T	$ 59,928
Buildings and Equipment	
Depreciation $75,000 @ 6%	$ 4,500
Repairs $75,000 @ 1%	750
Insurance	1,000
Total	$ 6,250

1/ The estimate was based on prices in October, 1967, in New Brunswick. Prices paid in other markets in Canada at the same time were as follows: Nova Scotia, 20.5¢; Québec, 19.0¢; Ontario, 19.0¢; Saskatchewan, 21.0¢; Alberta, 19.0 to 20.5¢; and British Columbia, 21.5¢.

2/ Price quotation from a New Brunswick hatchery, 1967.

3/ Bulk delivered prices at Moncton, New Brunswick.

Hired Labour

Regular man 1/		$ 2,400
Other labour 2/		960
	Total	$ 3,360

Other Costs

Fuel and electricity @ 3¢/bird		$ 3,600
Litter @ $7.50/1,000 birds		900
Taxes		620
Cleaning supplies, disinfectants, etc.		840
Interest on feed and birds 3/		800
Miscellaneous		350
	Total	$ 7,110

Total Expenditures $94,048

Per bird - 78.4¢
Per pound - 19.6¢

3) Net Income

i Net income of the basic enterprise.

Gross income	$100,800
Expenditure	94,048
Net income	6,752
Interest on capital (6%)	2,475
Labour income	4,277

1/ Assumed hiring a semi-retired man at $200 per month.

2/ Additional labour for takeout of mature birds.

3/ Seven per cent of the average outlay for feed and birds for one lot.

4/ Interest on capital was calculated at 6 per cent of average investment. New enterprises in a low equity position would have higher debt charges than this. For example, with 25 per cent equity and borrowed capital at 5 per cent, interest payments on borrowed capital in this enterprise would be $2,800.

ii Net income of the same enterprise in Nova Scotia.

Gross income 1/	$98,400
Expenditure 2/	91,328
Net income	7,072
Interest on capital (6%)	2,475
Labour income	4,597

iii Net income of the same enterprise in Ontario.

Gross income 3/	$93,600
Expenditure 4/	88,800
Net income	4,800
Interest on capital (6%)	2,475
Labour income	2,325

Appraisal of Poultry Enterprises

In the budget analysis of poultry enterprises, the profitability of both egg and broiler production was examined. Budgets were developed for two sizes of both enterprise types. The budget for the initial-stage laying enterprise was based on a 4,000-hen enterprise which raised its own replacements and delivered eggs to a grading station while the optimum-scale enterprise budget examined the profitability of a 12,000-hen caged-layer operation in which eggs were graded, packaged and delivered to a retail outlet. The budgets for broiler enterprises were based similarly on a 5,000-bird initial enterprise (20,000 per year) and a 30,000-bird optimum enterprise (120,000 per year). The differences in the net incomes of poultry enterprises among provinces reflected price spreads among major markets, differences in feed prices and other factors.

The budget analysis indicated that, in general, poultry enterprises in the Maritimes can compete successfully for the Maritime market with enterprises elsewhere. Production costs were slightly higher in the Maritimes for both

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1/ Based on the price of 20.5 cents per pound as of October, 1967.

2/ The lower expenditure reflects slightly lower prices for broiler feeds in Nova Scotia.

3/ Based on the price of 19.5 cents per pound in October, 1967, in Ontario. This price was 1.0 to 1.5 cents per pound lower than prices in the Maritimes.

4/ The lower expenditure reflects lower chick, feed and fuel costs. Production costs are about one cent per pound lower in Ontario than in the Maritimes.

broilers and laying enterprises, but the difference was about equal to the cost of transporting eggs and poultry meat from the competing regions to the Maritimes. The differences in costs are related mainly to feed costs.

Labour incomes in the budgeted optimum-scale laying enterprises ranged from about $7,200 in Nova Scotia to $11,640 in Prince Edward Island. The differences among provinces reflected differences in feed costs and average differences among Halifax, Charlottetown and Moncton in the prices paid by retailers for graded eggs. In Halifax the average price (unweighted) paid by retailers for Grade A Large eggs in cartons over the 1962-66 period was 51.7 cents per dozen. During 1966 and 1967, prices were generally about one cent per dozen higher in Moncton and two cents per dozen higher in Charlottetown than in Halifax. 1/

The labour incomes in the budgeted enterprises are somewhat higher than those indicated by several producers in this general size category. These producers indicated average labour incomes of about 50 cents per bird or about $6,000 for a 12,000-bird enterprise. The difference between the budgeted returns and those reported by Maritime producers may perhaps be explained by several factors: (1) unweighted prices give the price estimates an upward bias; (2) the labour force in some enterprises is larger than in the budgeted enterprise; (3) some enterprises indicate higher mortality rates than those assumed in the budget; (4) marketing costs are higher for some enterprises due to transportation costs involved in delivering eggs to widely separated outlets; and (5) feed costs are appreciably higher in some locations. These and other factors have varying impacts on laying enterprises in different locations and may tend to lower income levels below those indicated in the budgets.

The labour income in optimum-scale broiler enterprises in the Maritimes was estimated at between $4,300 and $4,600. Production costs appear to be about one cent per pound higher in the Maritimes than in Ontario and about three cents per pound higher than average production costs reported in 1966 by a group of Alberta enterprises. Average market prices are usually 1.0 to 1.5 cents per pound higher in the Maritimes than in Ontario, resulting in comparable levels of income in broiler production in the two areas.

1/ The higher labour income in Prince Edward Island reflects existing price relationships between Charlottetown and Halifax. The higher price in Charlottetown is likely a temporary situation and probably reflects differences between provinces in average egg quality, efficiency of production, competition among wholesalers, scale of existing enterprises and other factors. An increase in the number of larger enterprises would likely depress prices of graded eggs to near the prices in Halifax.

Maritime broiler production is confined almost entirely to Nova Scotia and New Brunswick. These enterprises, along with their service and processing facilities, are fairly well developed in these provinces, and it is difficult to envisage any substantial development in broiler production in Prince Edward Island. In fact there is little scope for expansion in broiler production anywhere in the Maritimes. The Maritime broiler market is already adequately supplied by Maritime producers. 1/ Any increases in demand for broiler meat will likely be supplied by increases in the scale of existing enterprises. The budget analysis indicated that efficient optimum-scale broiler enterprises in the Maritimes can compete successfully with other regions for the Maritime market, but indicated no potential for expansion beyond that market.

Egg production and consumption were almost in balance in the Maritimes in 1967, and for Maritime producers there appeared to be little scope for expansion beyond that market. There may be some opportunities in consolidation of some smaller enterprises, but the potential there is limited also. In Nova Scotia in 1961 about two-thirds of the egg and poultry sales of commercial farms were made by farms with product sales in excess of $25,000. The proportion has likely increased substantially since then. This suggests limited potential for expansion.

1/ An expansion of broiler production in New Brunswick has already been undertaken. This expansion was expected to take care of any deficiency in production that seemed evident from the significant movements of broilers from Québec into New Brunswick in 1966-67.

8. POTATO ENTERPRISES

Potato production in the Maritimes is important both in terms of the dominant role it plays in the agricultural economy of the region, particularly in Prince Edward Island and New Brunswick, and in terms of its position as a major potato-producing area in Canada. Potato sales account for roughly 20 per cent of the total cash receipts of Maritime farms. Their contribution to net farm income is even higher. The Maritime provinces account for about 35 per cent of total Canadian potato acreage and about 43 per cent of Canadian potato output. Moreover, the Maritime region is Canada's main seed producing area (85 per cent of total seed production) and the main exporter of Canadian potatoes (about 98 per cent of exports).

The budget analyses of potato enterprises was concerned with specialized enterprises in both New Brunswick and Prince Edward Island. The analyses attempted to reflect the effects of differences in soils, production methods, sizes of enterprises, quality of product and other factors on the profitability of potato production in the two provinces. In both provinces the enterprises were treated as cash-crop farms where all crops, including those produced as rotation crops, were assumed to be sold.

The budgets for initial-stage potato enterprises were based on enterprises representative of the upper 10 per cent of commercial potato enterprises, i.e., those reporting potato sales. On the basis of 1961 data, the average potato acreages on farms in this category were 25 to 30 acres in Prince Edward Island and 55 to 60 acres in New Brunswick. By 1966, because of significant changes in enterprise size, these sizes of enterprises no longer represented the upper 10 per cent. The average size of potato enterprises increased between 50 and 80 per cent in the main potato areas in the 1961-66 period. In terms of 1966 data, an enterprise with 60 acres of potatoes had become only an average-sized enterprise in Victoria county, New Brunswick.

The optimum-scale enterprise budgets examined the profitability of larger scale, mechanized potato enterprises. The analyses assumed appropriate improved yields and quality, mechanical harvesting and bulk storage and handling. The enterprises were considered to be basically one-man enterprises with extra labour hired during the cropping season and for harvesting, grading and loading. The budgets were based on enterprises producing 120 acres of potatoes in New Brunswick and 150 acres in Prince Edward Island. This is considered the average capacity of a mechanical harvester in the respective provinces.

The estimates of gross income and production costs assumed production for table stock and processing. Gross income and production costs would be higher than this on farms producing seed and average net incomes would also be higher. In New Brunswick, for example, it is commonly estimated that the net income of a seed producer with 75 acres of potatoes is equivalent to that of a table stock grower with about 100 acres. The higher gross income results from higher average prices for seed and lower culling rates than in table stock production. The higher production costs arise from higher seed costs, roguing to remove inferior plants and a few other factors.

Background Information

The Maritime provinces produce about 100,000 to 120,000 acres of potatoes annually (Table 8-1). Potato acreages range between 40,000 and 51,000 acres in Prince Edward Island; between 50,000 and 65,000 acres in New Brunswick; and between 5,000 and 8,000 acres in Nova Scotia. These acreages may be compared with annual averages of about 68,000 acres in Québec, 53,000 acres in Ontario and 69,000 acres in the western provinces. Maritime potato acreage accounts for roughly 35 per cent of total acreage in Canada. In terms of potato output, the Maritime provinces account for about 43 per cent of the total in Canada. This is reflected in the higher average yields in Prince Edward Island and New Brunswick than in most other areas (Table 8-2).

The average price to farmers of potatoes is generally lower than in other regions of Canada (Table 8-3). This reflects the fact that farmers in Prince Edward Island and New Brunswick rely on export markets for most of their potato sales. It also reflects the locational disadvantage of the area relative to growers and markets in central Canada. The generally higher quality of Maritime potatoes is reflected in higher retail prices in central Canada markets, but this advantage is offset by the freight charges involved in transporting potatoes to those markets.

Data on potato shipments from Prince Edward Island and New Brunswick indicate where the major markets for Maritime potatoes are. (Nova Scotia production is sold, mainly, within the province.) The bulk of potato shipments from Prince Edward Island to destinations in Canada go to Ontario (Table 8-4). Other important markets in Canada are Newfoundland and Québec. The main market in Canada for New Brunswick potatoes is Québec. The data on shipments do not include movement by trucks which accounts for a significant proportion of potato shipments to Québec.

TABLE 8-1

Potato Acreage in Canada and Selected Provinces, 1961-67

Year	Canada	Prince Edward Island	Nova Scotia	New Brunswick	Québec	Ontario	Western Canada
	thousand acres						
1961	305.7	46.2	8.1	54.2	80.3	51.5	65.4
1962	288.1	41.0	6.8	50.0	71.6	49.9	68.8
1963	285.4	42.0	6.9	53.0	68.0	51.0	64.5
1964	281.2	40.0	6.6	54.0	60.8	53.0	66.8
1965	298.8	43.0	7.0	57.0	63.5	56.0	72.3
1966	328.1	50.0	8.0	65.0	63.5	64.0	77.6
1967	303.8	51.0	5.0	62.0	71.0	48.0	66.8

Source: Quarterly Bulletin of Agricultural Statistics, D.B.S.

TABLE 8-2

Potato Yields in Canada and Selected Provinces, 1962-66

Year	Canada	Prince Edward Island	Nova Scotia	New Brunswick	Québec	Ontario	Western Canada
	cwt. per acre						
1962	162	182	137	214	134	192	122
1963	161	198	145	204	123	192	117
1964	170	209	146	215	135	198	121
1965	156	171	123	198	114	189	127
1966	174	189	157	198	117	240	137
Av. 1962-66	164	189	142	205	125	204	125

Source: Quarterly Bulletin of Agricultural Statistics, D.B.S.

TABLE 8-3

Average Farm Value of all Potatoes,

Canada and Selected Provinces, 1961-65

Year	Canada	Prince Edward Island	Nova Scotia	New Brunswick	Québec	Ontario	Western Canada
	----------	----------	----------	dollars per cwt.	----------	----------	----------
1961	1.40	0.91	1.64	0.89	1.55	1.57	2.37
1962	1.57	1.43	2.00	1.25	1.52	1.90	1.72
1963	1.72	1.50	1.80	1.40	1.85	2.00	1.88
1964	2.90	2.90	2.85	2.85	2.50	2.70	3.65
1965	2.41	2.20	2.70	1.90	2.53	2.85	2.57

Source: Crop & Seasonal Price Summaries, Vol. 19, Part II, Production & Marketing Branch, Canada Dept. of Agriculture, 1967.

TABLE 8-4

Potato Shipments from Prince Edward Island and

New Brunswick to Destinations in Canada, 1962-66

Origin - Destination	1962-63	1963-64	1964-65	1965-66
	----------	thousand cwt.	----------	
Prince Edward Island				
Newfoundland	743	824	718	769
Québec	767	1,297	1,303	1,325
Ontario	2,060	2,479	2,523	1,838
Canada	3,878	4,918	4,930	4,193
New Brunswick*				
Newfoundland	28	81	8	180
Québec	1,554	1,775	1,857	2,014
Ontario	1,301	1,374	1,134	1,124
Canada	4,344	4,841	4,373	4,428

* Figures for provinces do not include truck movement, but those for Canada do include truck shipments.

Source: Ibid.

Seed potato exporters in Prince Edward Island and New Brunswick have each developed a number of major markets (Table 8-5). The main markets for Certified seed from Prince Edward Island are the United States, Venezuela and Greece, while the main New Brunswick markets are Cuba, Argentina and Uruguay. In recent years total seed exports from New Brunswick have been somewhat larger than those from Prince Edward Island. Table stock exports from New Brunswick have also been larger than those from Prince Edward Island (Table 8-6). Important table stock markets include the United States, Trinidad, Puerto Rico and British Guiana. Table stock markets in Canada remain as the principal outlets for Maritime potatoes.

Data from the 1961 Census indicated that the average potato enterprise in the Maritimes is relatively small (Table 8-7). Such averages based on all farms reporting potatoes fail to provide a satisfactory indication of the significant commercial enterprises. Moreover, the proportion of enterprises which are commercial (reporting sales of potatoes) varies significantly among provinces. In Prince Edward Island, 87 per cent of farms reporting potatoes in 1961 also reported potato sales, as compared to 27 and 40 per cent in Nova Scotia and New Brunswick. Significant changes occurred in enterprise size from 1961 to 1966 (Table 8-8).

Potato production in the Maritimes is generally confined to a few relatively small areas. In Prince Edward Island, potato acreage is concentrated in three small areas; southeastern Prince county in the Summerside-Borden area (33 per cent), the Alberton-O'Leary district of western Prince (13 per cent), and the Souris district of northeastern Kings (10 per cent). 1/ In other farming areas, only a small proportion of cropland is devoted to potatoes. In New Brunswick, potato production is concentrated in the Upper St. John River Valley in the counties of Carleton (33 per cent), Victoria (41 per cent), and Madawaska (16 per cent). 2/ The greatest concentrations are found in the Grand Falls and Florenceville areas where over 50 per cent of crop acreage is devoted to potatoes.

1/ Percentages are based on estimates made in Raymond, C.W., et al., Land Utilization in Prince Edward Island, Memoir 9, Geographical Branch, Dept. of Mines and Technical Surveys, 1963.

2/ Percentages are based on 1961 Census data for commercial farms.

TABLE 8-5

Seed Potato Exports from Prince Edward Island and New Brunswick, 1962-66

Origin - Destination	1962-63	1963-64	1964-65	1965-66
	--------- thousand cwt. ----------			
Prince Edward Island				
U.S.A.	486	527	638	629
Venezuela	153	151	186	186
Greece	246	178	196	151
Cuba	-	-	-	-
Argentina	-	-	9	7
Uruguay	-	-	-	8
Italy	4	1	-	-
Other	113	65	32	33
Total	1,002	922	1,061	1,014
New Brunswick				
U.S.A.	8	176	511	108
Venezuela	98	119	60	32
Greece	46	18	35	31
Cuba	270	263	285	326
Argentina	649	217	162	46
Uruguay	316	379	349	230
Italy	65	56	45	130
Other	31	35	58	27
Total	1,483	1,263	1,505	930

Source: Ibid.

TABLE 8-6

Table Potato Exports from Prince Edward Island and New Brunswick, 1962-66

Origin - Destination	1962-63	1963-64	1964-65	1965-66
	--------- thousand cwt.			----------
Prince Edward Island				
U.S.A.	42	65	341	42
Trinidad	157	163	56	161
Puerto Rico	126	7	153	16
Italy	1	-	-	-
Argentina	-	-	-	-
British Guiana	78	30	5	65
Jamaica	63	41	30	15
Other	119	52	39	20
Total	586	358	624	319
New Brunswick				
U.S.A.	10	276	777	103
Trinidad	9	6	-	10
Puerto Rico	116	319	520	141
Italy	544	-	-	30
Argentina	488	-	-	-
British Guiana	7	4	-	12
Jamaica	1	-	5	3
Other	351	183	68	138
Total	1,526	788	1,370	437

Source: *Ibid*.

TABLE 8-7

Average Acreage of Potatoes on Farms

In the Maritime Provinces, 1961

	Prince Edward Island	Nova Scotia	New Brunswick
	acres		
All census farms	8.1	1.0	6.6
Commercial farms	10.3	1.6	12.5
Field crop farms	18.3	16.8	43.7
Upper 20 per cent*	19.7 ‡	3.3	28.0#
Upper 10 per cent	25.4 ‡	5.3	36.5#
Upper 5 per cent	32.0 ‡	8.7	58.0#
Commercial Enterprises**			
Upper 20 per cent	20.9	8.2	53.7
Upper 10 per cent	27.0	13.2	58.0 ‡‡
Upper 5 per cent	33.1	19.8	58.0 ‡‡

* Average acreage on the 20 per cent of farms with the largest potato acreage.

‡ Assumed farms in Prince Edward Island with more than 27.4 acres averaged 35 acres per farm.

Assumed farms in New Brunswick with more than 27.4 acres averaged 58.0 acres per farm.

** Acreage of potatoes on farms reporting potato sales. This assumed that the smallest enterprises are those which reported no sales. In Prince Edward Island, Nova Scotia, and New Brunswick, 87, 27 and 41 per cent, respectively, of the farms reporting potatoes reported potato sales in 1961.

‡‡ All farms in the upper 10 and 5 per cent reported more than 27.4 acres of potatoes. Data were not available to further subdivide the enterprises on an acreage basis.

Source: Census of Canada, Agriculture, D.B.S., 1961.

TABLE 8-8

Average Size of Potato Enterprises in Prince Edward Island And New Brunswick, 1961 and 1966

Area	1961	1966
	-------- acres	------
Prince Edward Island		
Province	8.1	11.5
Kings County	6.4	8.9
Prince County	10.8	16.0
Queens County	6.4	8.3
New Brunswick		
Province	6.6	11.9
Carleton County	26.1	46.6
Madawaska County	14.4	26.4
Victoria County	37.8	60.5

Source: Census of Canada, Agriculture, 1961 and 1966.

Budget Analysis of Initial-Stage Potato Enterprises

The initial-stage enterprise budgets were based on farms producing 30 acres of potatoes annually in Prince Edward Island and 60 acres in New Brunswick. The difference in acreage reflected the fact that, in the upper size categories, enterprises in New Brunswick are about twice as large as in Prince Edward Island. Total crop acreage was assumed to be 90 acres in New Brunswick and 60 acres in Prince Edward Island. This reflected, in part, the difference in intensity of potato production between the two provinces. Grain crops were assumed to be produced on the portion of the crop acreage not devoted to potatoes.

The estimates of costs and returns in the initial-stage budgets assumed average yields and prices, manual harvesting (picking), production of table stock potatoes and average inputs of fertilizer, chemicals, seed, etc. On-farm storage was assumed for both Prince Edward Island and New Brunswick enterprises.

a) Basic Assumptions

1) Productivity - Average yields for the 1961-66 period were used in the calculation of gross income for the initial-stage enterprises (Table 8-2). These were 190 cwt. per acre in Prince Edward Island and 205 cwt. per acre in New Brunswick. Marketed yields were lower

than those reflecting average culling rates in the two provinces. Grain crops grown in rotation with potatoes were assumed to yield one ton per acre (42 bushels of barley).

2) Mechanization - The equipment complement assumed for the enterprises included two-row planting and harvesting equipment, tillage machinery and equipment for picking and handling harvested potatoes. Hand picking and handling in barrels were assumed. Grain planting, spraying, and harvesting were assumed to be custom hired.

3) Labour Force - The labour force was assumed to consist of an operator, a seasonal hired man and extra labour for harvesting, grading and loading.

b) Input-Output Relationships

1) Cropping Inputs

i Fertilizer - Large quantities of commercial fertilizers are used in potato production. The rate of application and analysis used depend on soil type, fertility, rotation, variety, manure applications and product produced (seed, table stock, processing). In the past, application rates have averaged about one ton per acre. Under most conditions complete fertilizers (N-P-K) are required. In Prince Edward Island the common ratio is 1:2:2 and in New Brunswick it is 1:2:1. 1/ Higher analysis fertilizers are now being used with the result that application rates have declined on a total weight basis but have changed little on an active ingredient basis. For the initial-stage analysis the following rates were used:

Prince Edward Island	- 1,500 to 1,800 pounds of 8-16-16-1Mg 2/
New Brunswick	- 1,500 to 1,800 pounds of 8-16-8-1Mg 3/

1/ Potato Growing in the Atlantic Provinces, Pub. 1281, Canada Dept. of Agriculture, 1967.

2/ Fertilizers for Prince Edward Island, 1967, The Maritime Fertilizer Council, Moncton, New Brunswick.

3/ Fertilizers for New Brunswick, 1967, The Maritime Fertilizer Council, Moncton, New Brunswick.

ii Seed - Potato yield and quality are influenced, to a considerable degree, by quality of seed. Because potatoes are susceptible to a number of seed-borne diseases, it is important to use good seed stock. The use of Certified or better seed is encouraged in both provinces and, in fact, enforced in Prince Edward Island. Seeding rates vary widely according to variety, size of seed and other factors. Seed costs vary according to variety used, quality of seed and price. Estimates of seed costs range from $30 per acre to about $60 per acre. 1/For this analysis seed costs were estimated at $40 per acre.

iii Chemicals - Several types of chemical treatments are used in potato production. These include chemicals for control of weeds, insects and seed-borne and other diseases, as well as for killing the tops prior to harvesting and inhibiting sprouting of harvested tubers. In New Brunswick potatoes are sprayed about a dozen times and in Prince Edward Island six or seven times. Materials for the various pest control measures used are estimated at $10 to $13 per acre in Prince Edward Island and $15 to $18 in New Brunswick. 2/ Material costs were estimated at $12 per acre for Prince Edward Island and $16 per acre for New Brunswick in the budgets.

2) Labour Requirements - The labour requirements of potato enterprises vary according to acreage, degree of mechanization, rotation, yields and other factors. Data from a study in Maine indicate the labour requirements of various sizes of potato farms (Table 8-9). Labour requirements ranged from 1.2 man-equivalents for farms with less than 36 acres of potatoes to 3.3 man-equivalents per farm in enterprises with 100 to 150 acres. Data from an enterprise study in New Brunswick indicated labour inputs ranging from 48 hours per acre (not including picking) on farms with 60 acres of potatoes to 68 hours per acre on farms with 20 acres of potatoes.3/

1/ The lower estimate was based on information from the Farm Credit Corporation ($30 per acre with Certified seed and $35 per acre with Foundation seed) and the higher estimate is from E. Lewis, "Costs in Producing Potatoes", Proceedings of the Eighth Canadian Potato Industry Conference, Canadian Horticultural Council, Ottawa, 1966.

2/ The lower estimates are Farm Credit Corporation estimates based on data from farm appraisals and accounts.

3/ Report of the Royal Commission on the New Brunswick Potato Industry, 1962.

The labour requirements for potato production vary widely on a seasonal basis. Labour requirements are highest in the harvest season, especially when the picking operation is performed by manual methods. This seasonal distribution of labour requirements makes it necessary to hire large amounts of labour during the harvest season. The problems associated with high seasonal labour requirements are being overcome through mechanization, but a substantial proportion of Maritime potatoes are still harvested manually. In New Brunswick the stoniness of many of the soils and the general availability of labour restricted the use of mechanical harvesters in the main potato areas, but this was changing rapidly as enterprises continued to expand and labour costs to increase.

TABLE 8-9

Labour Requirements on Potato Farms, Maine, 1958 and 1959

Potato Acreage	Labour Requirements Per Farm	
	Man-Equivalents	Man-Work Units
Small:		
Less than 36 acres	1.2	357
36 to 49	1.4	424
Average (36 acres)	1.3	391
Medium:		
50 to 59	1.8	527
60 to 69	2.0	601
70 to 99	2.5	801
100 to 150	3.3	1,102
Average (72 acres)	2.3	698

Source: Pullen, W.E., and D.F. Tuthill, Cost of Producing Potatoes Central Aroostook County, Maine, Bull. 635, Maine Agricultural Experiment Station, 1965.

3) <u>Capital Requirements</u> - The capital requirements for potato enterprises are dependent on land values, machinery and equipment, and building investment. Indicators of the capital requirements for potato farms were obtained from a study in Maine and from 1961 Census data for field crop farms in New Brunswick (Table 8-10). Land and buildings account for the largest share of the capital investment. On Maine farms tractors, trucks and other equipment accounted for roughly one-quarter of the total investment and real estate accounted for the remainder. On the New Brunswick field crop farms, which were not all potato farms, investment in equipment was about half that in real estate in 1961. A large proportion of the real estate capital was invested in potato storage facilities.

The investment in machinery varies according to the size of enterprise, the degree of mechanization and the extent to which custom operations replace specific machines. The replacement cost of the machine complement for the intial-stage potato enterprises was estimated at $20,000 (Table 8-11). All machine operations, except seeding, spraying and combining grain crops, were performed by the farm operator.

The total capital investment for the initial-stage enterprises was estimated as follows on the basis of replacement costs for machinery and buildings:

	Prince Edward Island	New Brunswick
Land 1/	$ 9,000	$13,500
Buildings 2/	7,900	14,600
Equipment	18,000	20,000
Total	$34,900	$48,100

Average investment was estimated at about $23,000 for the Prince Edward Island enterprise and at $32,500 for the New Brunswick enterprise.

1/ 60 acres at $150 per acre in Prince Edward Island and 90 acres at $150 per acre in New Brunswick.

2/ Capital requirements for storage facilities were estimated at $1.75 per barrel.

TABLE 8-10

Capital Investment on Potato Farms in Maine and New Brunswick

	Maine*			New Brunswick‡
	Small	Medium	Large	Field Crop Farms
Cropland (acres)	80	152	444	94
Potatoes (acres)	36	72	234	43
Investment Per Farm (dollars)				
Tractors & Trucks	2,415	4,468	10,467	(7,233
Equipment	2,278	4,742	13,541	(
Real Estate	19,320	35,675	132,260	14,745
Total	24,013	44,885	156,241	21,978
Investment Per Cropland Acre (dollars)				
Tractors & Trucks	30	29	24	(77
Equipment	28	31	58	(
Real Estate	242	235	297	157
Total	300	295	351	234
Investment Per Acre of Potatoes (dollars)				
Tractors & Trucks	68	62	45	(168
Equipment	64	66	58	(
Real Estate	542	498	577	343
Total	674	626	683	511

* Pullen, W.E., and D.F. Tuthill, op. cit.

‡ Data are for field crop farms in the 1961 Census. Over 90 per cent of the farms in this group were in the potato area and were assumed to be potato farms.

TABLE 8-11

Equipment Complement for 90-Acre Potato Farm

In New Brunswick

Item	Size or Type	Replacement Cost
Tractor	40-50 H.P.	$ 5,000
Truck	2T	4,000
Plow	3 14-inch	500
Disc	8-foot	450
S.T. Harrow	12-foot	300
Planter	2-row	1,800
Cultivator	2-row	400
Sprayer	10-row	1,600
Digger	2-row	1,500
Seed Cutter		1,250
Barrel Loader		1,000
Containers		1,800
Tools & Misc. Equip.		500
		$20,100

c) Enterprise Budget - New Brunswick

1) Gross Income

Potatoes	- 60 acres @ 205 cwt./acre less 19% shrinkage @ $1.75/cwt.	$17,435
Grain	- 30 acres @ 1.0T/acre @ $48/T	1,440
	Total	$18,875

The gross income of potato enterprises varies mainly in response to yield and price changes. The above estimate of gross income was based on the average yield for the 1962-66 period (Table 8-2), the average price for Canada No. 1 Table Stock for the same period (Table 8-12), and the average shrinkage rate in packing table stock and Certified seed potatoes in New Brunswick (Table 8-13). During this period yields ranged from 198 to 215 cwt. per acre, prices ranged from $1.00 to $2.92 per cwt. and shrinkage ranged from 16 to 22 per cent. The effects on gross income of variations in these three factors were calculated as follows for this enterprise:

1.	Change of 10 cwt. per acre in yield	$ 850
2.	Change of 5 per cent in shrinkage	1,076
3.	Change of $0.25 per cwt. in price	2,490

TABLE 8-12

Prices Paid to Growers for Canada No. 1. Table Stock Potatoes Delivered at Shipping Point, 1957-1967

Crop Year	Prince Edward Island	New Brunswick
	----- dollars per cwt. --------	
1957-58	1.25	1.18
1958-59	1.48	1.13
1959-60	2.80	2.42
1960-61	1.57	1.42
1961-62	1.16	0.90
1962-63	1.64	1.28
1963-64	1.79	1.54
1964-65	3.20	2.92
1965-66	2.48	2.01
1966-June/67	1.21	1.00

Source: Markets Information Section, Production and Marketing Branch, Canada Dept. of Agriculture, Ottawa. Prices are simple averages of weekly quotations for potatoes delivered at shipping point in barrels or buyers' bags.

TABLE 8-13

Percentage Shrink in Packing Table Stock

And Certified Seed Potatoes for Shipment

In Prince Edward Island and New Brunswick, 1961-66

Crop Year	Prince Edward Island	New Brunswick
	-------- per cent	----------
1961-62	14.6	15.8
1962-63	15.1	16.1
1963-64	17.2	20.1
1964-65	13.9	19.1
1965-66	13.8	22.1
Weighted Average	14.9	18.9

Source: Fruit and Vegetable Division, Production and Marketing Branch, Canada Dept. of Agriculture, Ottawa.

2) Expenditures

Cropping Inputs

Fertilizer 1/	$3,150
Seed - Potatoes - 60 acres @ $40/acre	2,400
- Grain 30 acres @ $2.75/acre	82
Spray Materials - Potatoes @ $16/acre	960
- Grain @ $ 2/acre	60
Other - Lime and Miscellaneous Inputs	270
Total	$6,922

1/ 60 acres at 1,500 pounds of 8-16-8 per acre at $70 per ton.

Labour

Seasonal hired man 1/		$1,200
Harvest - picking 2/		1,875
- other 3/		360
Grading and loading 4/		1,500
	Total	$4,935

Machinery and Equipment

Tractor 5/	- 830 hours @ $1.25/hour	$1,037

Truck Operation 6/

5,000 miles @ 15¢/mile	$ 750

Cropping and Harvesting Equipment 7/

Depreciation	$11,100 @ 6%	$ 666
Repairs	$11,100 @ 2%	222
	Total	$ 888

1/ Six months (May-October) at $200 per month.

2/ Twenty-five cents per barrel for 125-barrels-per-acre yield.

3/ Hauling, three extra men at $12 per day for 10 days.

4/ Grading labour at $0.20 per barrel.

5/ Tractor costs were based on the following estimates: $5,000 replacement cost, 830 hours of use annually, useful life of 11 years, 10-per-cent scrap value, lifetime repair cost of 35 per cent replacement cost, and average fuel consumption of two gallons per hour.

6/ Based on 5,000 miles of annual use, 15-year life, repair rate of 2.5¢ per mile, and fuel consumption of 10 miles per gallon.

7/ Average useful life of machines was estimated at 15 years and repair costs at 30 per cent of replacement cost or 2 per cent per year.

Buildings 1/

Depreciation	$14,600 @ 5%	$ 730
Repairs	$14,600 @ 1.5%	220
Insurance		50
	Total	$ 1,000

Other Costs

Taxes 2/		$ 323
Custom combining 3/		240
Interest on operating capital 4/		210
Utilities		150
Miscellaneous 5/		300
	Total	$ 1,223

Total Expenditure	$16,755

3) Net Income

i Net income of the basic enterprise.

Gross income	$18,075
Expenditure	16,755
Net income	1,320
Interest on capital (6%)	1,950
Labour income	-630

ii Net income of the same enterprise on the basis of the 10-year average price of $1.58 per cwt.

Gross income	$17,182
Expenditure	16,755
Net income	427

1/ Useful life of storage buildings and equipment was estimated at 20 years. Replacement cost was estimated at $14,600.

2/ 1.5 per cent of average investment in land and buildings.

3/ 30 acres at $8 per acre.

4/ Six per cent for six months on cropping inputs of $7,000.

5/ Two per cent of operating costs. Items included in this category are insurance on stored potatoes, fuel for storage heating, sundry supplies, etc.

iii Net income of the same enterprise with a 150-barrel yield (248 cwt.) rather than 125 barrels (205 cwt.).

Gross income	$22,532
Expenditure	17,430
Net income	5,102

d) Enterprise Budget - Prince Edward Island

1) Gross Income

Potatoes - 30 acres 1/	$ 9,980
Grain - 30 acres 2/	1,500
Total	$11,480

2) Expenditures

Cropping Inputs

Fertilizer 22.5T @ $75/T	$ 1,688
Seed - Potatoes 30 acres @ $40/acre	1,200
- Grain 30 acres @ $2.75/acre	82
Spray Materials	
- Potatoes 30 acres @ $12/acre	360
- Grain 30 acres @ $2/acre	60
Other	225
Total	$ 3,615

Labour

Hired man 6 mos. @ $200/mo.	$ 1,200
Harvest - picking @ $0.25/bbl.	862
- other	180
Grading and loading @ $0.20/bbl.	690
Total	$ 2,932

Machinery and Equipment

Tractor - 500 hours	$ 600
Truck - 4,000 miles	630
Other equipment	848
Total	$ 2,078

1/ 30 acres at 190 cwt. per acre less 15-per-cent shrinkage at $2.06 per cwt.

2/ 30 acres at 1.0 tons per acre at $50 per ton.

Buildings

Depreciation, Repair and Insurance	$ 533

Other Costs 1/

Total	$ 735
Total Expenditure	$ 9,893

3) Net Income

i Net income of the basic enterprise.

Gross income	$11,480
Expenditure	9,893
Net income	1,587
Interest on capital (6%)	1,380
Labour income	207

ii Net income of the same enterprise on the basis of the 10-year average price of $1.86 per cwt.

Gross income	$10,512
Expenditure	9,893
Net income	619

Budget Analysis of Optimum-Scale Potato Enterprises

The budgets for optimum-scale enterprises assumed higher yields, better quality and a higher degree of mechanization than the initial-stage enterprises. The sizes of enterprises selected attempted to take into account differences between Prince Edward Island and New Brunswick in cropping methods, machine capacity (particularly mechanical harvesters) and other factors. The budgets were based on farms with 120 acres of potatoes and a total of 160 acres of cropland in New Brunswick, and 150 acres of potatoes and a total of 450 acres of cropland in Prince Edward Island. These acreages of potatoes are considered to be within the capacity of a mechanical harvester in the respective provinces.

1/ Taxes, interest on cropping inputs, custom work, utilities and miscellaneous expenditures.

The objectives of optimum-scale enterprises are generally more readily achieved with cash crop enterprises (potatoes, tree fruits, etc.) than with livestock enterprises. The nature of the labour inputs is such that a satisfactory level of income usually assures that the labour and social objectives are attainable. Labour requirements are high during the growing season but are not as time-specific as in livestock enterprises. This, along with much lower labour requirements in the winter months, assures access to social amenities if the level of income is adequate.

a) Basic Assumptions

1) Productivity - Yields were assumed to be 20 per cent higher than the averages used in the initial-stage budgets. On this basis yields were estimated at 150 barrels per acre (248 cwt.) in New Brunswick and 140 barrels per acre (230 cwt.) in Prince Edward Island. Grain yields were estimated at one ton per acre.

2) Mechanization - The estimates of machine costs were based on the use of two-row planters, four-row cultivators, mechanical harvesters, bulk boxes and bulk handling equipment.

3) Labour Force - The labour force was assumed to consist of one operator, one hired man and extra labour for harvesting, seed-cutting, grading and loading. Wage rates were estimated at $250 per month for regular hired labour, $12 per day for extra harvest labour and $0.20 per barrel for grading and loading.

b) Input-Output Relationships

1) Cropping Inputs - Per-acre inputs of fertilizer, seed, chemicals and other materials were assumed to be identical to those in the initial-stage budgets. In the Prince Edward Island enterprise one-third of the crop acreage was assumed to be seeded down to a forage crop. Some observers feel this is necessary to control soil erosion and to combat diseases.

2) Labour Requirements - The increased size and mechanization of the optimum-scale enterprises results in reduced labour inputs per acre and less seasonal variation in labour requirements than in the less-mechanized enterprises.

3) Capital Requirements - The estimates of capital requirements for optimum-scale enterprises were based on replacement costs for buildings and machinery and farmer estimates of land values. Total capital investment was

estimated at $106,000 for the New Brunswick enterprise and at $151,000 for the Prince Edward Island enterprise on this basis (Table 8-14). Average investment was estimated at $70,000 in New Brunswick and $113,000 in Prince Edward Island.

TABLE 8-14

Capital Requirements of Optimum-Scale Potato Enterprises

		Prince Edward Island	New Brunswick
		---- dollars -------	
Land*		$ 67,500	$ 24,000
Buildings	Storage‡	$ 35,000	$ 31,500
	Housing (hired labour)	8,000	8,000
	Other	3,000	3,000
Total		$ 46,000	$ 42,500
Equipment	Tractor	$ 7,300	$ 7,300
	Tractor	5,000	5,000
	Plow	1,000	1,000
	Disc	500	500
	Harrow	300	300
	Seed Cutter	2,000	2,000
	2-row Planter	1,800	1,800
	4-row Cultivator (2)	1,300	1,300
	10-row Sprayer	1,600	1,600
	2 used Trucks	3,000	3,000
	2 Bulk Boxes	1,600	1,600
	Harvester	10,000	10,000
	Bin Piler	2,000	2,000
	Rock Picker	-	2,000
Total		$ 37,400	$ 39,400
Total		$150,900	$105,900
Average Investment#		$113,000	$ 70,000

* Prince Edward Island, 450 acres at $150 per acre; New Brunswick, 160 acres at $150 per acre.

‡ Prince Edward Island, storage for 20,000 barrels at $1.75 per barrel; New Brunswick, storage for 18,000 barrels at $1.75 per barrel.

\# Assumed buildings and equipment at 55 per cent of replacement cost.

c) Enterprise Budget - New Brunswick

1) Gross Income

Potatoes - 120 acres @ 248 cwt./acre less 15% shrink @ $1.75/cwt. 1/		$44,268
Grain - 40 acres @ 60 bu./acre @ $0.70/bu.		1,680
	Total	$45,948

2) Expenditures

Cropping Inputs

Fertilizer 2/		$ 6,300
Seed - Potatoes @ $40/acre		4,800
- Grain @ $5/acre (custom hired)		200
Spray Materials - Potatoes @ $15/acre		1,800
- Grain @ $2/acre (custom)		80
Other cropping inputs		480
	Total	$13,660

Labour 3/

Hired man - year-round		$ 3,000
Extra harvest labour		864
Seed cutting @ $2.25/acre		270
Grading and loading		3,600
	Total	$ 7,734

Machinery and Equipment

Tractors - Large - 880 hours @ $1.55	$ 1,364
- Small - 625 hours @ $1.15	720
	$ 2,084
Trucks	$ 1,010

1/ Assumed a culling rate of 20 per cent for table stock, 10 per cent for processing potatoes, with output divided evenly between table stock and processing potatoes.

2/ 120 acres at 1,500 pounds of 8-16-8 per acre at $70 per ton.

3/ Regular hired labour at $250 per month, extra harvest labour at $12 per day and grading and loading labour at 20¢ per barrel.

Cropping and Harvesting Equipment

Depreciation $24,100 @ 10%		$ 2,410
Repair $24,100 @ 3%		723
	Total	$ 3,133

Buildings

Depreciation 1/ - Storage - $31,500 @ 6%		$ 1,890
- Other - $11,000 @ 5%		550
Repairs - $42,500 @ 1%		425
Insurance - $3.35/$1,000		142
	Total	$ 3,007

Other Costs

Custom combining 40 acres @ $8/acre		$ 320
Taxes 2/		710
Interest on cropping inputs 3/		570
Utilities		200
Insurance on stored potatoes		350
Miscellaneous		500
	Total	$ 2,650

Total Expenditure	$33,278

Per 75 lb. bag - $0.99

3) Net Income

i Net income of the basic enterprise.

Gross income	$45,948
Expenditure	33,278
Net income	12,670
Interest on capital (6%)	4,200
Labour income	8,470

1/ Assumed an average useful life of 15 years for storage buildings and 20 years for other buildings.

2/ 1.5 per cent of average investment in land and buildings.

3/ 7.0 per cent for seven months on $14,000.

ii Net income of the same enterprise on the basis of the ten-year average price of $1.58 per cwt. (Table 8-12).

Gross income	$41,648
Expenditure	33,278
Net income	8,370
Interest on capital (6%)	4,200
Labour income	4,170

d) Enterprise Budget - Prince Edward Island

The budget for the optimum-scale potato enterprise was based, to a large extent, on the results of consultations with Mr. E.K. Lewis of Freetown, Prince Edward Island. A preliminary budget for this enterprise was reviewed by Mr. Lewis. This preliminary budget, Mr. Lewis's comments and a revised version of the budget are presented in an Appendix to the potato enterprise analysis which appears at the end of this report. This Appendix illustrates the manner in which budgets for this and other enterprises were developed. The budget which follows is not identical to the one in the Appendix but it is very similar.

1) Gross Income

Potatoes	- Canada No. 1 Table Stock 1/	$57,474
	- Seconds 2/	2,205
Grain	- 150 acres @ 45 bu./acre @ $45/T	7,290
	Total	$66,969

2) Expenditures

Cropping Inputs

Fertilizer	- Potatoes 3/	$ 8,550
	- Grain 4/	2,010
Seed	- Potatoes @ $40/acre	6,000
	- Grain & Forage @ $5/acre	1,500
Spray Materials	- Potatoes @ $12/acre	1,800
	- Grain - custom @ $2/acre	300
Other Inputs	- Lime and other inputs	1,690
	Total	$21,850

1/ 150 acres at 230 cwt. per acre less 10 per cent shrinkage less 10 per cent seconds at $2.06 per cwt.
2/ 150 acres at 21 cwt. per acre at 70¢ per cwt.
3/ 150 acres at 1.0 ton of 6-12-12 per acre at $57 per ton.
4/ 150 acres at 400 pounds of 10-10-10 per acre at $67 per ton.

Labour

Hired men - 1.5 men @ $250/month	$ 4,500
Extra harvest labour @ $12/acre	1,800
Set-cutting @ $2.25/acre	338
Grading and loading	4,200
Total	$10,838

Machinery and Equipment

Tractors - Large - 1,400 hrs. @ $1.55/hr.	$ 2,170
- Small - 850 hrs. @ $1.15/hr.	978
Total	$ 3,148

Trucks

Depreciation, Repairs, Insurance and Fuel	$ 1,350

Cropping and Harvesting Equipment

Depreciation $22,100 @ 10%	$ 2,210
Repairs $22,100 @ 3%	663
Total	$ 2,873

Buildings

Depreciation - Storage	$ 2,100
- Other	550
Repairs - $46,000 @ 1.0%	460
Insurance - $3.35/$1,000	154
Total	$ 3,264

Other Costs

Custom combining @ $6.00/acre	$ 900
Interest on cropping inputs 1/	900
Taxes 2/	904
Utilities	300
Insurance on stored potatoes	350
Miscellaneous	500
Total	$ 3,854

Total Expenditure	$47,177
Per 75 lb. bag - $1.14	

1/ 7.0 per cent for seven months on $22,000.

2/ 0.8 per cent of average investment in land and buildings.

3) Net Income

i Net income of the basic enterprise.

Gross income	$66,969
Expenditure	47,177
Net income	19,792
Interest on capital (6%)	6,780
Labour income	13,012

ii Net income of the same enterprise on the basis of the 10-year average price of $1.86/cwt.

Gross income	$60,849
Expenditure	47,177
Net income	13,672
Interest on capital (6%)	6,780
Labour income	6,892

Appraisal of Potato Enterprises

The budget analysis of potato enterprises was based on specialized enterprises in New Brunswick and Prince Edward Island. Budgets were developed for small-scale enterprises and for what were considered to be optimum-scale enterprises in both provinces. The budgeted costs and returns for these enterprises attempted to reflect differences between the two provinces in prices, quality, yields and input levels. The initial-stage budgets were based on enterprises producing 30 acres of potatoes in Prince Edward Island and 60 acres in New Brunswick. The budgets for optimum-scale enterprises examined the profitability of farms producing 150 acres of potatoes in Prince Edward Island and 120 acres in New Brunswick. The larger enterprises assumed mechanical harvesting and bulk handling of potatoes. The difference in acreage between the enterprises reflects the average capacity of mechanical harvesters in the two provinces. Generally better soil and weather conditions result in a longer harvesting season in Prince Edward Island than in northern New Brunswick, hence the difference in potato acreage in the two budgets.

The budget analysis of initial-stage enterprises indicated unsatisfactory levels of income. The budgets for these enterprises were based on the production of table stock potatoes and assumed average yields, prices and shrinkage rates. If these enterprises were producing seed the levels of income would be substantially higher. These higher incomes would result from higher average prices and higher marketed yields due to the lower shrinkage in seed potatoes. Production costs would also rise, but less than gross income.

The budget analyses of optimum-scale enterprises indicated satisfactory levels of income in both New Brunswick

and Prince Edward Island. The analyses indicated that this enterprise has a comparative advantage and probably an absolute advantage over all other enterprises in both provinces in areas suited to potato production.

The estimates of labour incomes in the optimum-scale budgets indicated a substantial advantage for Prince Edward Island over New Brunswick. The advantage was indicated mainly in terms of a better quality product and, hence, higher prices. The superior quality of Prince Edward Island potatoes is reflected in lower shrinkage (culling) rates, higher average prices and better grades. 1/ The costs associated directly with potato production were very similar in the two provinces but the costs associated with rotation crops were higher in Prince Edward Island, hence total costs per unit of potato output were higher there. To some extent this reflects the difference in the cropping programs assumed for the two enterprises. These cropping programs may not be entirely comparable in terms of the measures incorporated into them for such items as erosion and disease control. The income advantage of the Prince Edward Island enterprise was based mainly on the higher-valued product produced. This advantage is partly offset by higher yields in New Brunswick. Some observers indicate that equally good potatoes can be produced in New Brunswick if adequate precautions are taken to prevent mechanical injury in harvesting. If this can, in fact, be achieved and then reflected in comparable prices, the advantage of the Prince Edward Island enterprise would be reduced.

The budgets were based on the production of table stock potatoes in Prince Edward Island and table stock and processing potatoes in New Brunswick. If these budgets were based on production for seed there would be less difference in the income levels of enterprises in the two provinces. Shrinkage rates are lower for seed potatoes than for other products and appear to be very similar in both provinces. This would tend to give New Brunswick a physical advantage in seed production because of higher average yields. There also appears to be less difference between the two provinces in prices for seed than for table stock (Table 8-15). Data on prices for seed potatoes are not very well developed but those that are available suggest a lower price advantage for Prince Edward Island over New Brunswick in seed than in table stock. It would appear from the available data that gross incomes per acre should be very similar in seed production in the two provinces.

1/ The annual potato quality surveys conducted by the Canada Dept. of Agriculture indicate generally higher proportions of table stock potatoes from Prince Edward Island in the "above average" categories than from New Brunswick.

An assessment of potato enterprises in the two provinces must take into account a number of physical differences between them. The potato lands in New Brunswick are adapted to very intensive cropping. The rock content of these soils is a detrimental factor in terms of mechanizing the harvesting operation, but is considered an advantageous factor in terms of soil aeration, prevention of erosion and soil compaction, increasing the infiltration rate, and in permitting necessary field operations (especially spraying) in wet weather. The potato lands in Prince Edward Island, on the other hand, are lighter-textured and generally free of stones and are, therefore, more susceptible to erosion and compaction and less adaptable to intensive cropping. This factor explains, in part at least, the generally lower degree of specialization in potato production in Prince Edward Island compared to New Brunswick.

TABLE 8-15

Average Bulk Prices to Growers in Prince Edward Island and New Brunswick for all Varieties, Sizes and Grades of Seed Potatoes, 1957-1966

Crop Year	Prince Edward Island	New Brunswick
	----- dollars per cwt. --------	
1957-58	1.33	1.62
1958-59	1.45	1.25
1959-60	2.92	2.33
1960-61	1.90	1.91
1961-62	1.02	1.47
1962-63	1.71	1.25
1963-64	1.51	1.42
1964-65	3.07	2.73
1965-66	3.31	2.51
1966-67	1.58	1.95
Average	1.98	1.84

Source: Markets Information Section, Production & Marketing Branch, Canada Dept. of Agriculture, Ottawa. Prices are simple averages of limited numbers of weekly quotations for particular crop years. The differences in individual years do not necessarily reflect differences in quality between the two provinces.

Prince Edward Island soils are, however, better adapted to mechanical harvesters than New Brunswick soils. Less risk of frost damage in the harvest season in Prince Edward Island allows the planting operation to be performed at a later date under generally better soil and weather conditions than in New Brunswick and extends the harvest season. In general, the higher yields and intensive cropping in New Brunswick tend to counter the effects of better quality, higher machine efficiency and generally better harvest conditions in Prince Edward Island.

Comparison of "average" potato enterprises in Prince Edward Island and New Brunswick indicates that New Brunswick is much more advanced in terms of mechanization, storage facilities and specialization. The average enterprise is much larger, the incidence of modern, on-farm storages is much higher, and potato enterprises tend to be more mechanized and specialized in New Brunswick. These factors suggest that average production costs are probably significantly lower in New Brunswick than in Prince Edward Island. 1/ They also indicate substantially greater capital requirements for storage facilities, machinery, farm consolidation, etc. in Prince Edward Island than in New Brunswick if equally efficient enterprises are to be developed in both provinces.

As potato enterprises become more specialized, grain becomes an important byproduct. This grain is produced at relatively low cost and could become a relatively profitable secondary or supplementary enterprise on potato farms. The potato areas in both Prince Edward Island and New Brunswick are currently surplus grain areas and probably will become more so. At the present time facilities to market and transfer this grain from these areas to the livestock feeding areas appear to be inadequate. The possibilities for establishing livestock enterprises nearby are worth examining.

Comparison of potato enterprises in the Maritimes with enterprises in Ontario indicates that efficient Maritime enterprises should be able to compete successfully in central Canada markets. The disadvantage of location relative to these markets is modified by a number of factors. These include the following:

1/ The effect of scale on production costs was indicated in Retson, G.C. "Cost of Producing Potatoes on Selected New Brunswick Farms in 1959", Economic Annalist, v. 32, 1962. Estimated production costs increased from \$1.49 per barrel to \$2.26 per barrel as acreage decreased from 60 acres to 20 acres.

1. Higher land costs in Ontario. Land values are currently two to three times higher in Ontario and are likely to continue to increase more rapidly there than in the Maritimes. Competition from other cash crops is an important factor in this increase in land costs.

2. Higher yields in the Maritimes. Marketed yields of efficient, productive enterprises are 10 to 20 per cent higher in the Maritimes than in Ontario.

3. Better quality in the Maritimes. Comparison of original packs of Prince Edward Island, New Brunswick and Ontario potatoes at wholesale in Ontario indicates a substantial quality advantage for Maritime potatoes, especially Prince Edward Island potatoes. (The greater quality advantage of Prince Edward Island over Ontario potatoes relative to New Brunswick and Ontario potatoes could explain, in large part, the larger volume of Prince Edward Island potatoes on the Toronto market and the concentration of New Brunswick potatoes on the Montreal market.)

4. Lower costs for some inputs in the Maritimes. Seed, spray materials and labour costs are higher in Ontario than in the Maritime provinces.

9. TREE FRUITS ENTERPRISE

Commercial tree fruits production in the Maritimes is concerned mainly with apple production and this budget analysis was, accordingly, based on the apple enterprise. Two sizes of enterprise were considered, the first similar to that on the average fruit and vegetable farm in Nova Scotia in 1961 and the second expanded to about 100 acres of bearing trees. The latter was considered an optimum-scale enterprise.

Tree fruits production in the Maritimes in 1967 was concentrated in the Annapolis Valley of Nova Scotia. New Brunswick was producing apples mainly for the local fresh market and Prince Edward Island produced practically no commercial tree fruits. In Nova Scotia about 70 per cent of the apple crop was processed, about 10 per cent exported as fresh fruit and the remainder sold, mainly in Nova Scotia, as fresh fruit. In total, about two-thirds of Nova Scotia apple production was exported out of the Atlantic region, either as fresh fruit or processed products. Apples and apple products are Nova Scotia's main agricultural exports.

Background Information

Tree fruits production in the Maritimes has been increasing in recent years after a long period of reductions in tree numbers, acreage and production. In Nova Scotia, tree numbers exceeded two million during the 1920's and 1930's but declined rapidly after about 1940 and reached a low point of less than 600,000 trees in the early 1960's (Table 9-1). During the earlier period (1920-1940) the bulk of Nova Scotia's apple production (about 80 per cent) was exported fresh to the United Kingdom. In subsequent years this fresh apple market declined in the face of competition from other suppliers, resulting in declines in fresh apple production and increases in processing in Nova Scotia. The increase in production in recent years reflects increases in yields and tree numbers. Recent increases in tree plantings in both Nova Scotia and New Brunswick suggest that these upward trends will continue.

Nova Scotia produces about 13 or 14 per cent of the total Canadian apple crop (Table 9-2). About 70 per cent of its production is processed, about 10 per cent is exported as fresh fruit and the balance is sold as fresh fruit in Canada, mainly in Nova Scotia (Table 9-3). About half of the processed product is exported to the United Kingdom while the other half is marketed in the Atlantic region and central Canada. About 75 per cent of Nova Scotia's fresh apple exports are shipped to the United Kingdom.

TABLE 9-1

Apple Trees in the Annapolis Valley, Selected Years

Year	Total Apple Trees
	thousands
1939	1,588
1949	1,123
1954	727
1959	583
1964	560
1966	620

Source: Apple Tree Survey 1966, Tree Plantings and Removals, Annapolis Valley, Nova Scotia, D.B.S., Truro.

TABLE 9-2

Apple Production, Canada and Selected Provinces, Selected Periods and Years

Year	Canada	Distribution By Provinces			
		N.S.	Qué.	Ont.	B.C.
	000 bu.	------- per cent --------			
1951-55 (annual av.)	14,131	13.8	19.4	21.9	42.5
1956-60 (annual av.)	15,153	14.6	22.3	25.2	35.2
1961	16,521	19.1	22.0	33.4	25.9
1962	20,049	12.3	29.9	25.2	30.2
1963	21,937	13.2	24.2	22.4	38.1
1964	20,052	12.1	18.8	32.5	34.5
1965	22,292	13.9	34.7	24.1	25.2
1966	21,058	14.1	19.5	28.2	36.2

Source: Crop and Seasonal Price Summaries, Vol. 19, Part II, Production and Marketing Branch, Canada Dept. of Agriculture, 1967.

TABLE 9-3

Disposition of Nova Scotia Apple Production, Selected Years

Year	Production	Export	Processed	Fresh Sales in Canada
	000 bu.	per cent		
1956-60 (annual av.)	2,216	18.0	60.0	22.0
1961	3,151	20.2	61.0	18.8
1962	2,461	15.9	67.7	16.4
1963	3,180	11.6	71.2	17.2
1964	2,430	10.6	68.7	20.7
1965	3,100	10.3	72.0	17.7
1966	2,962	8.7	70.7	20.6

Source: Agricultural Statistics 1966, Province of Nova Scotia, Pub. 7, Nova Scotia Dept. of Agriculture and Marketing, Halifax.

New Brunswick apple production is concerned mainly with the fresh apple market in that province. About 90 per cent of New Brunswick output is sold within the province. Annual output ranges between 425,000 and 525,000 bushels, or roughly one-sixth of the Nova Scotia crop. While New Brunswick does export some apples (mainly to the United Kingdom and to processing plants in Nova Scotia) imports into New Brunswick from other parts of Canada (mainly British Columbia and Québec) are about double the volume of exports.

Apple tree distributions by variety and age of trees for the Annapolis Valley suggest a trend toward fresh fruit varieties and away from traditional cooking and processing apples (Tables 9-4 and 9-5). The two main varieties reported in 1964 were McIntosh and Delicious, and subsequent plantings have also emphasized these varieties. Approximately two-thirds of the non-bearing trees in 1964 were fresh fruit varieties. The trend toward fewer varieties also appears to be continuing. In New Brunswick the principal varieties are McIntosh and Delicious, reflecting that province's emphasis on production for the local fresh market.

TABLE 9-4

Apple Varieties, Annapolis Valley

Variety	Total Apple Trees 1964	Apple Tree Plantings 1964-66
	per cent	
McIntosh	19.3	29.4
Common and Red Delicious	14.6	11.9
Gravenstein and C. Gravenstein	9.6	2.9
Wagener	9.4	0.2
Northern and Red Spy	10.5	17.2
Spartan	1.2	9.1
Others*	35.4	29.3
Total	100.0	100.0

* Individual varieties account for less than 10 per cent of all trees or 1964-66 plantings.

Source: A Sample Census of Apple Trees in the Annapolis Valley of Nova Scotia, 1964; and Apple Tree Survey, 1966.

TABLE 9-5

Distribution of Trees by Age and Type,

Annapolis Valley, 1964

	All Trees	1964 Plantings	Non-Bearing Trees*	Bearing Trees‡
	per cent			
Fresh Fruit	42.2	73.5	66.3	33.6
Processing	24.8	9.8	12.9	29.1
Dual Purpose	33.0	16.7	20.8	37.3

* Trees less than 10 years old.

‡ Trees 10 years and over.

Source: A Sample Census of Apple Trees in the Annapolis Valley of Nova Scotia, 1964.

Tree fruits enterprises in Nova Scotia are, on the average, larger than those in New Brunswick (Table 9-6). In 1961, the average size of tree fruits enterprises in Nova Scotia was 9.6 acres as compared to 4.5 acres in New Brunswick. On fruit and vegetable farms the average acreage of trees was about 35 acres in Nova Scotia and 20 acres in New Brunswick. The budget for the initial-stage enterprise was based on an average of these fruit and vegetable farms in Nova Scotia. Relative to apple enterprises in the Annapolis Valley, the initial-stage enterprise would represent about an average of the top third of these specialized enterprises in 1964 (Table 9-7). These larger enterprises account for a large proportion of the total number of trees and an even larger proportion of recent plantings. In 1964, about half the apple trees in the Annapolis Valley were reported by about 10 per cent of the orchard operators. These same operators reported 85 per cent of new plantings.

TABLE 9-6

Classifications of Tree Fruit Enterprises,

Nova Scotia and New Brunswick, 1961*

Location and Farm Classification*	Farms Reporting		Area of Orchards	Apple Trees	Average Product Sales#
	Trees‡	Sales			
	no.	no.	acres	no.	$
Nova Scotia					
All farms	1,364	849	9.6	437	2,628
Commercial farms	891	616	13.1	596	3,539
Fruit & vegetable farms	179	310	34.8	1,740	7,187**
Kings County, Nova Scotia					
All farms	631	496	16.0	770	3,915
Commercial farms	463	385	20.0	962	4,967
New Brunswick					
All farms	526	222	4.5	224	1,833
Commercial farms	277	129	6.2	308	2,800
Fruit & vegetable farms	47	132	19.6	980	4,418‡‡

* Data pertain to farms in the indicated classification which reported tree fruits in the 1961 Census.

‡ Farms reporting more than 25 trees.

\# Average for farms reporting sales.

** Average fruit and vegetable sales for 310 fruit and vegetable farms of which 179 reported an acreage of tree fruits.

‡‡ Average fruit and vegetable sales for 132 fruit and vegetable farms of which 47 reported an acreage of tree fruits.

Source: Census of Canada, Agriculture, 1961.

TABLE 9-7

Distribution of Apple Enterprises by Tree Numbers, Annapolis Valley, 1964

Number of Trees	Proportion of Operators*	Average Trees Per Enter-Prise	Proportion of Total Trees‡	Average Area#	Proportion of 1964 Plantings
	%	no.	%	acres	%
Up to 200	40.7	103	6.0	2.1	0.3
201 - 400	20.9	311	9.3	6.2	0.3
401 - 800	16.9	555	13.4	11.1	9.6
801 - 1,600	12.3	1,090	19.1	21.8	4.8
1,601 - 3,200	6.3	2,171	19.4	43.4	11.6
3,201 - 5,000	1.5	4,103	8.8	82.1	13.2
5,000 and over	1.4	12,158	23.9	223.2	60.2
All operators	-	701	-	14.0	-

* Percentage of 798 operators with more than 30 trees.

‡ Proportion of all trees (559,554) operated by the respective groups of operators.

\# Based on 50 trees per acre.

Source: A Sample Census of Apple Trees in the Annapolis Valley of Nova Scotia, 1964, D.B.S., Truro, in co-operation with the Nova Scotia Dept. of Agriculture and Marketing.

Budget Analysis of an Initial-Stage Tree Fruits Enterprise

The budget for the initial-stage enterprise was based on an orchard with 35 acres of apple trees. Estimates of gross income were based on average yields and prices in Nova Scotia in recent years. These averages were based on data for the entire crop. It was not possible to indicate the difference between enterprises producing for the fresh market and those producing processing apples. Data which

indicate differences in yields, prices and production costs for the two types are not available. There seems to be general agreement that the gross income from fresh apples is higher than for processing apples, but production and marketing costs are also higher and the net results of the two do not appear to be very much different. An evaluation of the two types of products would have to account for differences in yields, production costs, marketing costs, prices, variability in prices and yields and other factors before a satisfactory comparison could be made. Such a comparison would require more data than are currently available.

The estimates of production costs, production methods, capital investment, labour requirements and other inputs were based mainly on data from orchard operators in the Annapolis Valley in Nova Scotia and in the Keswick area in New Brunswick. Data from the New England states were also used where pertinent and where unavailable from local sources.

a) Basic Assumptions

1) Productivity - Apple yields were estimated at 300 bushels per bearing acre. Bearing acreage was estimated at 29 acres in a 35-acre orchard. The replacement rate was estimated at 2 per cent per year, i.e., trees were assumed to be 50 years old when replaced and 9 years old before reaching bearing age, hence 18 per cent of the orchard was assumed to be non-bearing trees. 1/

2) Mechanization - The analysis assumed ownership of all of the major machines used in apple production. These included a tractor, power sprayer, mower, pruning and picking equipment and facilities for bulk handling of apples.

3) Labour Force - the labour force for the enterprise was assumed to consist of an operator and seasonal contract or piecework labour hired for pruning and picking.

b) Input-Output Relationships

1) Cropping Inputs - In general, data pertaining to physical inputs (fertilizer, chemicals, lime, etc.) were not readily available. These inputs were usually described in terms of per-unit costs and have been shown as such in the enterprise budget.

1/ This estimate is confirmed in Farm Management Handbook, A.E. Ext. 212, Cornell University, 1962.

2) Labour Requirements - The labour requirements of apple enterprises vary by size of enterprise, type of fruit produced, yields and seasons. The effect of the size of the enterprise may be indicated by New York data (Table 9-8). The estimates exclude all harvest labour. These data suggest that per-acre labour requirements for growing apples decline about 10 per cent each time acreage is doubled. Estimates obtained in Nova Scotia place picking labour requirements at 60 hours per acre at a yield of 300 bushels per acre. 1/ Non-picking harvest labour requirements (supervision, hauling apples, transporting pickers, etc.) have been estimated at 15 to 20 hours per acre. 2/

TABLE 9-8

Labour Required in Growing Apples,

New York State

Task	Size of Orchard (acres)		
	10-29	30-49	50 and Over
	----- hours per acre ------		
Pruning	29	26	19
Spray and dust	5	3	3
Supervision	3	3	6
Other	15	13	12
Total	52	45	40
Average acreage	22	41	77

Source: Farm Management Handbook, A.E. Ext. 440, Cornell University, 1966.

1/ Based on estimates by G. Kinsman, Nova Scotia Dept. of Agriculture and Marketing. Output was estimated at 300 bushels per week per man including wet days and non-working days. Data from several large growers tend to substantiate this estimate.

2/ Farm Management Handbook, 1962, op. cit.

An additional labour input is required for growing replacement trees to bearing age. New plantings require pruning, some cultivation, mowing, fertilizing, etc. New York data indicated a labour input of 107 hours per acre to grow orchards to bearing age, or about 12 hours per acre per year. 1/ On the basis of these various estimates a labour input of 127 hours per acre is indicated. This estimate is made up as follows:

Growing	-	45 hours
Harvest-picking	-	60 hours
-other	-	20 hours
Replacement	-	2 hours
		127 hours

An important element in the time required for orchards has not been included in these estimates. This element can be described as orchard inspection or orchard management. Success in apple production is dependent, to a large degree, on the proper timing of particular operations, hence a large labour input is required for examining trees in order to time the various spray applications and other treatments precisely. The problem is accentuated by the effects of year-to-year differences in temperature, rainfall, humidity, sunshine, etc., on the incidence, date of occurrence and severity of various disease and insect infestations. This characteristic of the management time requirements for operation of an orchard results in higher labour efficiency in large orchards than in small ones. When orchards are combined with other enterprises (dairy, hogs, poultry, etc.) the inspection job can often not be performed adequately because of seasonal labour conflicts. When this conflict results in the productivity of the orchard declining, the other enterprise must be considered as a competing enterprise. These requirements for inspection in orchards can result in very great advantages for specialization and larger scale.

The division of total labour requirements between operator and hired labour depends, to a large degree, on the size of the orchard. In small orchards, labour inputs by the operator in pruning, non-picking harvest labour, supervision, etc., are ordinarily high; in larger orchards the operator can be free of all but a small part of these operations. In this analysis, it was assumed that pruning, picking and part of the non-picking harvest labour were hired operations and hence cash expenses. All other operations were assumed to be performed by the operator or regular hired labour.

1/ *Ibid*.

3) Capital Requirements - The capital requirements of an orchard include land (with trees), buildings and orchard equipment. Land in prime orchards (including buildings) is valued at about $700 to $800 per acre in the Annapolis Valley. 1/ Older orchards with a higher proportion of old trees are valued at about $400 per acre (without buildings). 1/ Estimates provided by orchard operators place market values in the $500-to-$700 range without buildings and equipment. These orchards have a normal complement of new and older trees, i.e., enough new plantings to replace old and unproductive trees. Estimates of the investment required to develop an acre of bearing orchard range from $800 to $1,000. Included in these estimates are all costs incurred over the eight- to ten-year period from planting to bearing age. 2/

Buildings do not constitute a large investment in orchards unless the farm home is included in the estimate. Apples normally are not stored by the farmer, hence no investment is required for on-farm apple storage buildings. Farmers deliver apples directly to storage facilities operated by the various processors and shippers. The only building required, other than a house, is a shed for equipment and supplies.

The equipment investment varies with the size of enterprise and the degree of mechanization. Equipment investment per acre declines as acreage increases, even though orchard operators normally change to more power equipment as size of orchard increases. Data from New York orchards illustrate the equipment economies which can be achieved through increased scale of operations. 3/ In New York in 1962 investment per acre in orchard equipment was $137, $133 and $66 in orchards with 22, 41 and 77 acres of apples, respectively. 4/

1/ Estimates are based on Farm Credit Corporation appraisals. A rule-of-thumb measure used is $100 per acre plus $10 per tree.

2/ These estimates compare with Ontario estimates of about $1,100 per acre.

3/ Farm Management Handbook, 1966, *op. cit.*

4/ Orchard equipment in these enterprises included spray and dust equipment, power pruners, mowers, irrigation equipment, ladders, etc., but excluded tractors and trucks.

For the initial-stage enterprise the following equipment complement was assumed:

Tractor	$3,500
Power sprayer	4,200
Mower	500
Pruning equipment	200
Picking equipment	200
Front-end loader and fork lift	1,000
Wagons	500
Water supply (well, pump, etc.)	500
Fuel storage, tools, etc.	500
Total	$11,100

The average investment was estimated at $6,100. On individual farms this investment figure will be modified to the extent that some machines are used in other enterprises, other machines are added, or custom operations replace some machines.

New technology could change the capital structure of orchards very significantly in the near future. Mechanical harvesters which are now in the trial and development stages could change the capital requirements of orchards very substantially in a few years. A few of these machines have been built and are being tested in the northeastern United States. These machines cost about $25,000 each. Another machine which is expected to cost about $14,000 to $20,000 is under construction in Nova Scotia and is expected to be available for trial use in 1967. The machine is designed to harvest processing apples. If these harvesters become operational, orchards will need to be adapted to these machines. This will require changes in tree spacing, tree size, pruning techniques, orchard location with respect to topography, etc.

The capital structure and physical organization of orchards is undergoing significant changes at present even in the absence of mechanical harvesters. Old orchards which had 40 to 60 trees per acre are being replanted with 90 to 100 trees per acre. Trees are kept smaller through the use of dwarfing rootstocks and pruning. These smaller trees facilitate easier picking and spraying and reach maturity at an earlier age than the older types of plantings. Both yield and quality of fruit are being improved by these measures. Another factor which is affecting the physical organization of orchards is the discovery that quality and size of fruit declines as trees get older. Some orchard operators

expressed the view that in order to get adequate size in fruit, improve quality of fruit, minimize pruning costs and keep tree size down, trees may eventually be replaced at 25 to 30 years of age rather than at 50 years or more as is now common practice.

The capital investment in a 35-acre orchard was estimated as follows on the basis of replacement costs:

Land and trees @ $600/acre		$21,000
Equipment		11,000
Buildings		1,000
	Total	$33,000

c) Enterprise Budget (Initial)

1) Gross Income

Apples - 29 acres @ 300 bu./acre @ $1.00/bu.	$ 8,700

The gross income of apple enterprises varies with yield and quality of apples, kind of apples produced, size of enterprise and prices received for apples. The size of enterprise assumed for this analysis was 35 acres which included 18 per cent non-bearing trees. Bearing acreage was estimated at 29 acres. Yield of fruit is affected by weather conditions, adequacy of orchard management (fertility, spraying, pruning, etc.), varieties grown and other factors. A yield of 300 bushels per bearing acre, or 250 bushels for all acres, was assumed in this analysis. In the better orchards average yields of 400 to 500 bushels are achieved. Yield data from two orchard operators in Nova Scotia show the year-to-year and inter-orchard variations that occur in apple production (Table 9-9). Substantial year-to-year variations in the prices were also indicated by these growers. (The weighted average price received by both growers over the six-year period was $1.00 per bushel.) Average prices received by all growers in the apple-producing areas in eastern Canada over the 1961-65 period indicate substantial interprovincial variations in prices (Table 9-10). The higher prices in New Brunswick, Québec and Ontario reflect the higher proportions of fresh apples in these areas.

The effects of quality and type of apple on prices were indicated by information obtained from an apple grower in Nova Scotia. In 1966 this grower received an average farm price of $1.36 per bushel for his best variety of processing apples. The same grower received

TABLE 9-9

Examples of Yields and Prices of Apples

Nova Scotia, 1960-65

Year	Orchard No. 1		Orchard No. 2*	
	Yield	Price	Yield	Price
	bu./acre	$/bu.	bu./acre	$/bu.
1960	222	1.10	180	1.21
1961	233	1.02	252	1.01
1962	233	1.11	264	1.18
1963	238	0.80	198	0.79
1964	206	0.96	180	1.11
1965	246	1.00	188	0.84
Av. 1960-65‡	230	1.00	205	1.00

* The lower yields in Orchard No. 2 are partly a reflection of the fact that this orchard was being expanded and had a higher proportion of young trees than Orchard No. 1. Yields were based on total orchard acreage.

‡ Weighted averages.

Source: Operator returns.

TABLE 9-10

Average Farm Value of Apples,

Selected Provinces, 1961-65

	1961	1962	1963	1964	1965
	------ dollars per bushel -----				
Nova Scotia	0.94	1.01	0.81	1.01	1.00
New Brunswick	1.15	1.20	1.23	1.25	1.23
Québec	1.34	1.24	1.52	1.94	0.92
Ontario	1.14	1.33	1.46	1.57	1.55

Source: Crop and Seasonal Price Summaries, Vol. 19, Part II, Canada Dept. of Agriculture, Ottawa, 1967.

$1.02 per bushel for a different processing variety because it contained a high proportion of small apples priced at about $0.75 per bushel. The price received for McIntosh apples was $1.56 per bushel, but packing and storage charges of $0.53 per bushel reduced the farm price to $1.03 per bushel.

2) Expenditures

Pruning 1/	$ 580
Fertilizer 2/	645
Lime 3/	100
Spray materials 4/	1,015
Other materials 5/	150
Tractor operation 6/	574
Sprayer operation 7/	447

1/ Based on a wage rate of $10 per day, 50 trees per acre and 25 trees pruned per day.

2/ Based on 1967 Nova Scotia fertilizer recommendations for medium fertility orchards. Fertilizer application rates were assumed to be 650 pounds of 6-12-12-1B on bearing acreage and one pound per tree, per year of tree age, for young trees.

3/ Based on one-half ton per acre per year to maintain pH. Custom spreading at $5.75 per ton was assumed.

4/ Estimated by orchard operators at $35 per bearing acre. This compares with $70 to $80 per acre in New York cost accounts and $80 per acre in some Ontario orchards.

5/ Materials for weed, insect and rodent control in young orchards.

6/ Estimated at $1.55 per hour based on a replacement cost of $3,500 and annual use of 370 hours. The estimate includes depreciation, repairs, fuel, lubricants and insurance.

7/ Based on a replacement cost of $4,200, depreciation rate of 6 per cent, repair rate of 3 per cent and fuel consumption of 9 gallons per acre for 9 sprays on 29 bearing acres.

Other equipment 1/	$ 272
Harvesting 2/	
Picking	1,740
Other harvesting costs	325
Taxes 3/	387
New trees 4/	60
Miscellaneous costs (2%)	120
Total	$6,415

Cost per bearing acre - $221.20

Cost per bushel - $0.74

3) Net Income

Net income of the basic enterprise.

Gross income	$8,700
Expenditures	6,415
Net income	2,285
Interest on capital (6%)	1,656
Labour income	629

1/ Based on a replacement cost of $3,400, depreciation rate of 6 per cent and repair rate of 2 per cent.

2/ Estimates of picking costs ranged from $0.17 to $0.20 per bushel. The larger growers were able to get pickers in 1966 at the lower price, but many of the smaller growers paid the higher price. Prices were expected to move up to near $0.20 for all pickers in 1967. Other harvesting costs were estimated at 5.0 cents per bushel. These costs included 1.25 cents per bushel for moving apples out of the orchard onto trucks (included in tractor costs), and 3.75 cents per bushel for transportation and housing for pickers.

3/ Estimated at 1.8 per cent of investment in land and buildings. The estimate was based on data for fruit and vegetable farms in the 1961 Census.

4/ Based on $1.00 per tree and planting density of 90 trees per acre on two-thirds of an acre per year.

Budget Analysis of an Optimum-Scale Tree Fruits Enterprise

The budget of an optimum-scale enterprise was based on an orchard with 100 acres of bearing trees. Labour requirements are such that one operator, with a hired man during the growing season, can operate an orchard of this size. Extra labour is hired on a contract or piecework basis for pruning and picking. When non-bearing acreage is included, the total orchard acreage in such a one-man enterprise would be in the 120- to 125-acre range. An orchard of this size is within the capacity of one power sprayer.

In apple enterprises, as in most cropping enterprises, a satisfactory level of income assures access to social amenities. Labour inputs are high in some seasons but are generally less time-specific than in livestock enterprises. This, along with the fact that labour inputs are relatively low in the winter months, makes the normal social amenities available to one-man enterprises if satisfactory incomes can be achieved.

a) Basic Assumptions

1) Productivity - Yields were estimated at 400 bushels per bearing acre. Some orchard operators are achieving these yield levels now with higher rates of fertilization and better management than that assumed in the initial-stage enterprise.

2) Labour Force - The labour force assumed for the enterprise was an operator, a seasonal hired man and contract labour for pruning and picking.

3) Mechanization - The estimate of capital investment in machines assumed two tractors, power sprayer, rotary mower, roto-tiller, truck, power pruner and equipment for bulk handling of apples.

4) Capital Requirements - The total capital investment for the optimum-scale enterprise was estimated at $106,550 on the basis of replacement costs (Table 9-11). Average investment was estimated at $91,500.

b) Enterprise Budget

1) Gross Income

Apples - 100 acres @ 400 bu./acre @ $1.00/bu.	$40,000

TABLE 9-11

Capital Requirements for an Orchard with 100 Acres

Of Bearing Trees in Nova Scotia

Item		Replacement Cost
Land and trees - 122 acres @ $600/acre		$ 73,200
Equipment - 2 tractors	$8,000	
- Power sprayer	4,200	
- Mower	500	
- Roto-tiller	750	
- Truck (2T)	4,500	
- Power pruner	2,000	
- Loaders and fork lifts	2,000	
- Picking equipment	700	
- Water supply	500	
- Wagons	500	
- Tools, fuel storage, etc.	500	
		24,150
Buildings - Housing (hired labour)	$8,000	
- Supply storage	1,200	
		9,200
Total Capital		$106,550

2) Expenditures

Pruning @ $20/acre	$2,000
Fertilizer	3,200
Spray materials @ $35/acre	3,500
Lime	350
Tractor operation 1/	1,500
Sprayer operation 2/	870

1/ $8,000 replacement cost, depreciation rate 6 per cent, repair rate 4 per cent, 1,220 hours of use at 2 gallons per hour, plus 15 per cent for lubricants and 0.25 per cent for insurance.

2/ $4,200 replacement cost, depreciation rate of 10 per cent, repair rate of 5 per cent, fuel consumption of 1 gallon per acre per spray, and average of 9 sprays per year.

Truck operation 1/		$ 845
Other equipment 2/		780
Other materials 3/		365
Harvesting		
Picking - 40,000 bu. @ 20¢/bu.		8,000
Other - 40,000 bu. @ 2¢/bu. 4/		800
	Total	$22,210

Other Costs

Seasonal hired man @ $75/week		$ 2,000
Interest on operating capital $10,000 @ 6% for 6 mos.		300
Taxes		1,400
New trees		220
Buildings		
Depreciation, repairs and insurance		580
Miscellaneous		522
	Total	$ 5,022

Total Expenditure	$27,232

Per bearing acre - $272

Per bushel - 68¢

3) Net Income

i Net income of the basic enterprise.

Gross income	$40,000
Expenditure	27,232
Net income	12,768
Interest on capital (6%)	5,490
Labour income	7,278

1/ $4,500 replacement cost, 6.0 per cent depreciation, 3.0 cents per mile for repairs, 10 miles per gallon, 50 miles per acre and $150 for licence and insurance.

2/ Replacement cost of $7,450, depreciation rate of 7.5 per cent and repair rate of 3.0 per cent.

3/ Weed, insect and rodent control in young orchard.

4/ Based on hiring two men for five weeks in addition to picking and regular labour for hauling apples out of orchard, loading and hauling to storage. Truck and tractor costs were included above.

ii Net income of the same enterprise in New Brunswick.

Gross income 1/	$48,000
Expenditure 2/	31,232
Net income	16,768
Interest on capital (6%)	5,490
Labour income	11,278

Appraisal of Tree Fruits Enterprises

The budget analysis of tree fruits enterprises was based on two sizes of apple orchards in the Annapolis Valley. The budget for the initial-stage enterprise was based on a 35-acre orchard with 29 acres of bearing trees. This scale of enterprise corresponded to the average on fruit and vegetable farms in Nova Scotia in 1961. The optimum-scale enterprise budget was based on an orchard with 100 acres of bearing trees.

The budget analysis of the initial-stage enterprise indicated an unsatisfactory level of income. With average yields and prices net income was estimated at about $2,300 and labour income at $600 in this enterprise. The labour income of the optimum-scale enterprise was estimated at $7,300 and appeared satisfactory in terms of the income objective established. Apple enterprises appeared to have a comparative advantage over other enterprises in areas suited to orchards.

Fresh apple production in the Maritimes will likely continue to be restricted largely to local markets. A recent study of the Nova Scotia apple industry came to the following conclusion:

> "Nova Scotia is more able to be competitive in price and especially quality in the processing sector than in the fresh apple field. Nova Scotia's fresh apples are not as good as those produced in many other apple-growing regions. When it comes to colour, size and firmness Nova Scotia apples are often inferior to apples produced in British Columbia, Québec, the United States, Italy and France." 3/

1/ The higher gross income reflects the higher average price in New Brunswick. Prices are normally 20 to 25 cents per bushel higher in New Brunswick than in Nova Scotia.

2/ The higher expenditure reflects higher picking costs in New Brunswick. All other costs were assumed to be the same. Field work in the apple-producing areas provided no basis on which to make other distinctions between Nova Scotia and New Brunswick enterprises.

3/ Mulder, N.G., An Analysis of the Nova Scotia Apple Industry (1930 to 1972), Voluntary Economic Planning, Halifax, 1964.

It appears then that there may be little potential for expansion of fresh apple production in the Maritimes for either central Canada or overseas markets, unless these conditions change. The quality differential between Nova Scotia apples and other Canadian apples has restricted Nova Scotia's fresh apple sales in Canada largely to the Atlantic region. The major importer of fresh apples from the Maritimes now is the United Kingdom (taking about 75 per cent of exports). British entry into the Common Market would likely reduce or eliminate this market for Nova Scotia producers. The recent devaluation of the pound has already had repercussions for apple producers there.

Expansion in apple production is likely to be restricted mainly to supplying the processing industry. Apples suitable for processing can be produced at relatively low cost in the Maritimes. These lower production costs in the Maritimes are due to a number of factors:

1. Lower spraying costs in the Maritimes. Spray material costs alone (aside from application costs) are about half those in other apple-producing areas.

2. Lower land costs than in central Canada and British Columbia.

3. Labour costs in the Maritimes are lower than in the other areas. Picking costs, for example, were 17 to 20 cents per bushel in Nova Scotia relative to 30 cents per bushel in Ontario.

The net income of the optimum-scale enterprise in the New Brunswick situation was substantially higher than the net income of the Nova Scotia enterprise. This reflected a price differential of 20 to 25 cents per bushel between the two provinces. This price differential is related to several factors: (1) the shortage of fresh apple supplies in New Brunswick as compared to the surplus situation in Nova Scotia; (2) the production of apples for the fresh market rather than mainly for processing as is the case in Nova Scotia; and (3) the possibility that the quality of fresh apples is higher in New Brunswick than in Nova Scotia.

10. FEED GRAIN ENTERPRISE

Feed grains are produced in the Maritimes largely as a byproduct of potato farms and as a companion crop in establishing forage crops. Grain enterprises are almost always supplementary or secondary enterprises on other types of farms. Grain is the principal source of income on few, if any, farms in the region. Where grain is produced as a cash crop, there is usually another farm or non-farm enterprise which provides the major and more reliable source of income. The general unprofitability of grain production in the Maritimes in past years is indicated by the smallness of the grain acreage and by the secondary nature of most grain enterprises.

Any expansion in grain production in the Maritimes, aside from that associated with increases in potato acreage, would require some degree of specialization. This analysis examined the profitability of specialized grain enterprises, although results were not entirely satisfactory because of the lack of pertinent data. The data assumptions used in the enterprise budget need to be tested before the appraisal of this enterprise can be presumed to be dependable. The scale of grain enterprise selected for the budget - 400 acres - was based on a number of estimates of machine capacity, labour requirements and other factors.

Background Information

Feed grain production in the Maritimes has been confined largely to potato farms where grain is used as a rotation crop, and to dairy farms where it is used as a companion crop in establishing forage stands. The potato areas in New Brunswick and Prince Edward Island are surplus grain areas, but the Maritime region as a whole produces only about half the grain required for its present output of livestock and livestock products. Over the five-year period from 1962 to 1966 grain production in the Maritimes averaged 51 per cent of requirements. 1/ Grain production as a proportion of requirements varies substantially among provinces in the Maritimes. Prince Edward Island, which normally has about half the grain acreage in the region, produces about 84 per cent of its annual requirements; Nova Scotia, on the other hand, produces only 20 per cent of its requirements, New Brunswick about half.

1/ The estimate of requirements was based on production plus grain imports under feed freight assistance. See Tables 10-1 and 10-2.

TABLE 10-1

Freight-Assisted Shipments of Feed Grain to the Maritime Provinces, 1962 to 1966

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	----------- thousand tons			----------------
1962	19.2	108.7	71.5	199.4
1963	28.6	145.9	85.1	259.6
1964	23.1	137.2	78.2	238.5
1965	38.6	161.7	82.8	283.1
1966	29.9	148.8	77.3	256.0
Av. 1962-66	27.9	140.5	79.0	247.4

Source: Canadian Livestock Feed Board, Montreal.

Prince Edward Island and New Brunswick account for about 85 per cent of the total grain acreage and grain output in the Maritimes (Tables 10-2 and 10-3). The high proportion of the total Maritime grain acreage in these two provinces reflects the important role of grain on potato farms. On these farms grain is produced as a rotation crop, usually on residual fertility from the preceding potato crop and at relatively low cost. Most of the grain grown outside the potato areas is seeded as a companion crop with forage crops. This role is, however, declining in importance. The detrimental effects of cereal crops on establishment of underseeded forage crops have been recognized by farmers and many of them are tending toward direct seeding of forage crops. Where companion crops are seeded for weed and erosion control they are often harvested as forage.

The average acreage of grain on Maritime farms is relatively low. In 1961 the average acreage of oats on commercial farms was 24 acres, 11 acres and 19 acres on farms in Prince Edward Island, Nova Scotia and New Brunswick, respectively (Table 10-4). Oats are the main grain crop grown in the Maritimes and account for about 75 per cent of the total acreage. Mixed grains, which are mainly oats, account for most of the remainder. The average acreage of all grains on commercial farms was estimated at 27, 14 and 22 acres in Prince Edward Island, Nova Scotia and New Brunswick, respectively (Table 10-5). These acreages are probably overestimated since they assume that the total number of farms with grain is equal to the number of farms which reported oats.

TABLE 10-2

Grain Production in the Maritimes, 1962-66

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	----------	thousand tons		--------------
1962	149.3	33.0	91.4	273.7
1963	135.9	32.3	70.9	239.1
1964	160.1	39.8	80.2	280.1
1965	113.1	31.8	73.0	217.8
1966	173.2	44.6	84.4	302.2
Av. 1962-66	146.3	36.3	79.9	262.5

Source: Quarterly Bulletin of Agricultural Statistics, D.B.S.

TABLE 10-3

Grain Acreage in the Maritimes,1962-66

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	----------	thousand acres		--------------
1962	158.6	47.6	114.6	320.8
1963	157.3	42.4	100.7	300.4
1964	152.0	45.6	96.9	294.5
1965	151.8	43.9	103.6	299.3
1966	147.6	43.2	94.5	285.3

Source: Quarterly Bulletin of Agricultural Statistics, D.B.S.

TABLE 10-4

Average Acreage of Oats on Farms

In the Maritimes, 1961

	Prince Edward Island	Nova Scotia	New Brunswick
	---------	acres	-----------
Census Farms	19.4	8.0	14.4
Commercial Farms	23.5	10.6	19.2
Upper 20 Per Cent*	44.4	22.1	39.7
Upper 10 Per Cent	58.1	30.0	51.8
Upper 5 Per Cent	70.8	38.2	66.8

* Average acreage on the 20 per cent of farms with the largest oats acreage.

Source: Census of Canada, Agriculture, 1961.

TABLE 10-5

Average Acreage of Grain on Farms

In the Maritimes, 1961

	Prince Edward Island	Nova Scotia	New Brunswick
	---------	acres	-----------
Census Farms	30.5	10.3	16.1
Commercial Farms	37.0	13.7	21.5
Upper 20 Per Cent	70.0	28.5	44.4
Upper 10 Per Cent	91.6	38.8	58.0
Upper 5 Per Cent	111.6	39.4	74.8

Source: Assumed oat acreage was 63.0 per cent of grain acreage in Prince Edward Island, 77.3 per cent in Nova Scotia and 89.3 per cent in New Brunswick in all farm categories. These proportions were indicated in the 1961 Census for total grain acreages in the respective provinces. The acreages are probably overestimated because of the assumption that the number of farms with grain was equal to the number of farms reporting oats.

The average farm value of grain over the 1961-65 period was estimated at $47.65 per ton in Prince Edward Island, $52.35 per ton in Nova Scotia and $48.25 per ton in New Brunswick. This estimate was based on average values reported for oats over this period (Table 10-6). These estimated values compare with prices of $51 to $56 per ton for oats and $52 to $54 per ton for barley at Moncton in 1966 and 1967 (Table 10-7).

TABLE 10-6

Average Farm Value of Oats

In The Maritimes, 1961-65

Year	Prince Edward Island	Nova Scotia	New Brunswick
	---- dollars per bushel ---		
1961	0.85	0.96	0.83
1962	0.78	0.88	0.81
1963	0.80	0.88	0.82
1964	0.80	0.86	0.82
1965	0.85	0.90	0.85
Av. 1961-65	0.81	0.89	0.82

Source: Quarterly Bulletin of Agricultural Statistics, D.B.S.

TABLE 10-7

Prices Paid for Feed Grain at Moncton, New Brunswick,

1966 and 1967*

	Fall 1966	Winter 1966	Fall 1967
	-- dollars per cwt.---		
Barley	2.70	2.70	2.60
Oats	2.55	2.80	2.70
Wheat	3.00	3.35	3.05

* Based on the following maximum moisture content: wheat, 14.5 per cent; oats, 14.0 per cent; and barley, 14.8 per cent.

Source: Maritime Co-operative Services, Moncton.

Budget Analysis of Feed Grain Enterprises

a) Basic Assumptions

1) Productivity - Average grain yields in the Maritimes over the 1962-66 period ranged from 0.73 tons to 1.05 tons per acre. Research results suggest yield potentials of up to 2.00 tons per acre with high-yielding varieties and recommended inputs of fertilizer, lime and other inputs. These data fail to take into account a number of factors which would tend to reduce yields in large-scale specialized enterprises: (1) weather conditions often delay seeding beyond the optimum data; (2) soil conditions hamper seedbed preparation and seeding; and (3) weather conditions in the fall hamper and sometimes prevent harvesting operations and result in substantial crop losses. The budget analysis assumed that average yields of 60 bushels (1.44 tons) of barley per acre can be attained under Maritime conditions. The extent of the arable land area to which this assumed yield level would apply is an unknown at this stage.

2) Cropping Program - The budget analysis assumed that continuous grain production is feasible in the Maritimes. This assumed that disease problems could be overcome by alternating crops, using various chemical sprays, replacing seed stock frequently, etc. It also assumed that topography is such that erosion is not a serious problem. The amount and location of land with characteristics suitable for such a cropping program had not yet been determined.

3) Market - The analysis assumed a location near a major feed-processing plant in the Maritimes. The price estimates used were based on data from farmers and grain buyers in the Maritimes. These price estimates ranged from about \$45 per ton to \$60 per ton for barley. Prices received by farmers appeared to vary by location and the moisture content of the grain.

b) Input-Output Relationships

1) Capital Requirements - Estimates of capital requirements attempted to take into account factors such as the cost of acquiring suitable land; the capital inputs in the form of lime, drainage, field consolidation, etc., required to raise the productivity of the land to a point consistent with the yield estimate used; the capital investment required for machinery of sufficient capacity to operate the indicated acreage under Maritime conditions; and the capital investment in buildings for grain and equipment storage.

Estimates of capital requirements for land range widely by location, soil type, topography and soil conditions (pH, fertility, drainage, etc.). The estimate of capital requirements for land was based on the following estimates of the components in land value in the Maritimes.

i <u>Land</u> - Estimates of the cost of cleared, but otherwise unimproved land range from $50 to $150 per acre.1/ This analysis assumed that land of suitable soil type, topography and location could be acquired at a price of $100 per acre.

ii <u>Lime</u> - The correction of soil acidity often requires an input of six to ten tons of lime per acre. 2/ Custom rates for spreading lime (material, trucking and spreading) range from about $5.50 per ton in Nova Scotia and New Brunswick to $7.50 per ton in Prince Edward Island. An investment of $50 per acre in lime was assumed. In Prince Edward Island the lime requirement in terms of tonnage would generally be lower than in the other provinces.

iii <u>Drainage</u> - With the soil and climatic conditions which prevail in the Maritimes most land needs at least some tile drainage. The amount required varies from drainage of wet spots to systematic drainage in areas with heavy soils. The cost of installing tile drainage ranges from $15 to $20 per acre for the former to upwards of $100 per acre for systematic drainage. 3/ It is likely that the higher priced land would need less drainage than the lower priced land. In general, soils in Prince Edward Island would require less drainage than soils in either Nova Scotia or New Brunswick.

1/ Such unimproved land refers to cleared land with a low pH, low fertility, no tile drainage, small fields, etc.

2/ Estimate obtained from the Experimental Farm, Canada Dept. of Agriculture, Charlottetown.

3/ This is the cost to the farmer. The total cost of tile drainage installation would be more than double this amount if the government subsidy were included in the estimate. In Nova Scotia, for example, a subsidy of 13 to 17 cents per foot is paid to the operator of the tile-laying machine. In heavy soils an adequate drainage system requires up to 1,000 feet of tile per acre.

iv Field Consolidation - Estimates of the cost of field consolidation range widely by areas and by sources of information. In many cases the estimate is included with other land improvement costs. 1/ Estimates of $100 per acre for lime, removal of fences, removal of tree rows, and drainage of wet spots are encountered frequently.

The total capital investment required for land suitable for grain production appears to be at least $200 per acre. 2/ With systematic drainage the capital investment would be much higher.

Estimates of capital requirements for machinery and equipment for the size of enterprise considered in this analysis were difficult to obtain. The lack of specialization in grain production in the Maritimes and the problem of estimating machine capacities under the climatic conditions encountered there are important factors in this. The following estimates must be considered tentative at this stage:

Item	Size or Type	Replacement Cost
Tractor	75 H.P.	$ 7,300
Tractor	30-40 H.P.	4,800
Truck	2-ton with box	4,500
Combine	12-foot S.P.	13,000
Grain Dryer		6,000
Plow	5-bottom	1,000
Drill	2 26-run	3,100
Sprayer	30-foot	350
Tillage Equipment		3,000
Fertilizer Spreader	12-foot	450
Grain Loader	25-foot	350
Misc. - tools, fuel storage, shop equip.		1,000
	Total	$44,850

1/ One estimate from the Annapolis Valley in Nova Scotia placed land acquisition cost at $150 per acre and the cost of improvements (lime, fertilizer, fence-row removal, drainage, etc.) at $100 per acre for a total investment of $250 per acre for land suitable for grain production. Barley yields on this land were estimated at 50 to 75 bushels per acre.

2/ In Prince Edward Island, where capital inputs in drainage and possibly lime would be lower, the capital investment per acre may be about 25 per cent lower than this estimate.

Investment in buildings would need to include facilities for grain and equipment storage. The following estimate assumed replacement costs for these items.

Item	Size or Type	Replacement Cost
Grain Storage	24,000 bu.	$7,200
Equipment Storage	1,500 sq. ft.	2,250
	Total	$9,450

The total capital investment required for a 400-acre grain enterprise in the Maritimes was estimated as follows:

Land - 400 acres @ $200 per acre 1/	$ 80,000
Machinery	44,850
Buildings	9,450
Total	$134,300

2) Labour Requirements - The labour force assumed for this enterprise was an operator and a hired man. The hired man would be employed for about six months in the grain enterprise. Wages paid for experienced, reliable men in the Maritimes range from $75 to $100 per week.

c) Enterprise Budget

1) Gross Income

Grain 2/ - 22,800 bu. @ $54/T	$29,549

2) Expenditures

Cropping Inputs 3/

Seed @ $5/acre	$ 2,000
Fertilizer - @ 600 lbs. of 10-10-10-2M/ acre @ $70/T	8,400
Spray materials @ $1.20/acre	480
Lime @ 0.5T/acre	1,200
Miscellaneous	50
Total	$12,130

1/ In Prince Edward Island the investment in land could possibly be reduced by $20,000 due to lower capital inputs in drainage and lime.

2/ Assumed a total crop of 24,000 bushels and a 5-per-cent weight loss due to drying. The price estimate was based on prices paid by Maritime Co-operative Services in Moncton in 1966 and 1967 (Table 10-7).

3/ Based on information from Maritime farmers.

Tractor Operation

Large tractor - 2 hrs./acre @ $1.55/hr.		$1,240
Small tractor - 1 hr./acre @ $1.25/hr.		500
	Total	$1,740

Combine Operation 1/

Depreciation - $13,000 @ 9%		$1,170
Repairs		520
Fuel and lubricants		220
	Total	$1,910

Truck Operation

Depreciation - $4,500 @ 6%		$ 270
Repair - $4,500 @ 2%		90
Licence and insurance		150
Fuel and lubricants		275
	Total	$ 785

Grain Dryer

Depreciation and repair $6,000 @ 8%		$ 480
Fuel (propane)		300
	Total	$ 780

Other Machinery and Equipment 2/

Plow		$ 250
Tillage equipment		500
Seeding equipment		250
Other equipment		150
	Total	$1,150

1/ Assuming a useful life of 10 years, salvage value of 10 per cent of replacement cost and total repair cost of 40 per cent of replacement cost over the life of the machine.

2/ Including depreciation and repair costs.

Buildings 1/

Depreciation	- $9,450 @ 5%	$ 472
Repairs	- $9,450 @ 1%	95
Insurance	- @ $10/$1,000/3 years	32
	Total	$ 599

Other Costs

Taxes $90,000 @ 1.5%	$ 1,350
Interest on seed and fertilizer 2/	425
Hired labour - 6 mos. @ $350/mo.	2,100
Miscellaneous	350
Total	$ 4,225
Total Expenditure	$23,319

3) Net Income

i Net income of the basic enterprise.

Gross income	$29,549
Expenditure	23,319
Net income	6,230
Interest on capital (6%) 3/	6,600
Labour income	-370

ii Net income of the same enterprise at a price of $60 per ton for grain.

Gross income	$32,832
Expenditure	23,319
Net income	9,513
Interest on capital (6%)	6,600
Labour income	2,913

1/ Assuming an average useful life of 20 years for buildings.

2/ Based on 7 per cent of $10,400 for seven months. This cost could be substantially higher than this.

3/ Based on 6 per cent of $110,000.

Appraisal of the Feed Grain Enterprise

The budget analysis of the feed grain enterprise was based on a 400-acre enterprise. With the kind and quality of data available in 1967 this analysis must be considered as only a rough estimate of the potential of this enterprise in the Maritimes. A number of reasons for this could be cited. First, there is no reliable estimate of the amount of land which is suitable for grain production. In 1967, the land most suitable for grain production was devoted to potato and fluid milk production. It seems unlikely that grain enterprises would displace much of this land. Second, there are insufficient data on which to base a budget for a grain enterprise. These inadequacies in data are evident in many areas:

1. Yields under conditions which would prevail on grain farms in the Maritimes are not available. Research station data do not adequately reflect the climatic and other physical limitations which a specialized grain farm would encounter under practical farm conditions.

2. Estimates of capital requirements for grain production range widely and vary according to location, soil type and other factors.

3. The physical capacity of specific machines, e.g., combines, under Maritime conditions has not been adequately established.

4. Estimates of inputs required for specific output levels vary widely. The input estimates concerned include fertilizer, lime, labour, fuel and other inputs.

5. The feasibility of continuous grain production has not yet been satisfactorily demonstrated.

Grain production in the Maritimes is handicapped by a number of severe physical limitations. The climate of the Maritimes is, generally, not well suited to grain production. Cold, damp weather in the spring hampers seeding operations and limits the rate of plant growth. Similar conditions in the fall delay maturity, hamper harvest operations and often result in substantial crop losses. Soils in the Maritimes are generally infertile, acidic and often poorly drained. Poor topography in many areas results in excessively small fields, erosion and other problems. These limitations have implications for grain production in terms of capital and labour requirements, physical productivity, operating inputs, risk, etc. The limitations imposed by soils can be partially overcome by relatively large capital inputs in the form of drain-

age, lime, machinery, etc., and large inputs of fertilizer, labour, fuel, etc. The effects of climate can be partially overcome by large capital inputs per acre in higher-capacity tractors, tillage machinery, combines, grain dryers and other equipment which permit the necessary tasks (seeding, tillage, harvesting, etc.) to be performed in the relatively short periods available for them. These inputs, however, add substantially to the cost of grain production.

A large proportion of the feed grain produced in the Maritimes is a byproduct of potato enterprises in Prince Edward Island and New Brunswick. This grain is produced at relatively low cost on residual fertility from preceding potato crops. Its value as a cash crop is, however, often depressed by a lack of storage and transportation facilities which hinders its transfer from the surplus grain areas to the livestock feeding areas. Farmers in western New Brunswick, for example, ship grain to feeding areas in the Fredericton and Moncton areas and also to Maine. Freight charges on grain moving to other areas in New Brunswick are paid by the government of that province. At the same time some grain is moving into these producing areas under feed freight assistance.

The budget analysis of the feed grain enterprise indicated no return to labour at current prices for feed grains in New Brunswick after allowing for interest on capital. In Prince Edward Island the estimate of labour income was much lower reflecting the lower current price for feed grain there.1/ A risk factor which would reflect the effects of weather in both spring and fall on grain production should be included in budgets of grain enterprises in the Maritimes. This is a very real cost in grain production in that region but lack of pertinent data does not permit a reliable estimate of this cost at this time. 2/

In contrast to the budgeted Maritime enterprise, grain enterprises in western Canada are generally profitable. This profitability is to a large extent related to physical resources. A comparison of the physical resources between the Maritimes and western Canada in terms of suitability for grain production weighs heavily in favour of the latter area. The climate of the western region is well suited to grain production. Large, relatively level land areas permit the use of large efficient machines and the development of large-scale enterprises. The adaptability of these large land areas to

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1/ Prices paid for barley in 1967 were about \$54 per ton (basis 14.8-per-cent moisture) in New Brunswick and \$42 per ton (basis 20- to 25-per-cent moisture) in Prince Edward Island.

2/ Some potato farmers estimate risk in potato production at 7 to 10 per cent of production costs. The risk is probably much greater in grain production in the Maritimes.

mechanized operations results in highly specialized, well-mechanized farms with high levels of labour efficiency. These characteristics of grain production in western Canada become apparent upon examination of data from Saskatchewan grain enterprises (Table 10-8). These data are based on the account books of farmers who were members of Saskatchewan farm management clubs in the period from 1960 to 1964.

TABLE 10-8

Summary of the Resource Base, Capital Investment, Annual Costs And Returns on Grain Farms in the Dark Brown Soil Zone In Saskatchewan by Size of Farm, 1960-1964

Item	Unit	Cultivated Acres				
		0 to 480	481 to 800	801 to 1,120	1,121 to 1,440	1,440 and Over
Resource Base						
Cultivated land	acres	411	657	961	1,243	1,897
Total land	acres	508	727	1,055	1,341	2,010
Labour	man-year	1.1	1.2	1.2	1.4	1.7
Investment						
Land	$	16,974	23,514	32,906	50,122	86,623
Buildings	$	7,614	8,174	8,781	10,786	18,305
Equipment	$	10,719	9,907	13,564	16,368	23,471
Livestock	$	1,242	1,669	1,492	1,059	1,281
Total	$	36,549	43,264	56,743	78,335	129,680
Farm Costs						
Cash operating	$	3,453	4,307	7,152	8,369	14,073
Depreciation	$	1,346	1,401	1,401	1,972	2,858
Total	$	4,799	5,708	8,553	10,341	16,931
Returns						
Gross income	$	9,036	12,569	17,940	24,093	36,099
Farm costs	$	4,799	5,708	8,553	10,341	16,931
Net income	$	4,237	6,861	9,387	13,752	19,168
Investment cost (5%)	$	1,827	2,163	2,837	3,917	6,484
Labour income	$	2,410	4,698	6,550	9,835	12,684
Net income/gross income	%	48.2	56.9	55.8	59.8	53.2

Source: Saskatchewan Farm Business Summary, Five-Year Average 1960-1964, Extension Report. No. 9, Farm Management Division, Agricultural Representative Branch, Saskatchewan Dept. of Agriculture, 1965.

The Saskatchewan data suggest that there are very significant economies of scale in grain production in western Canada. The more efficient use of capital on large farms is indicated by the reduction in the investment per acre for machinery and buildings as farm size increases. The investment per cultivated acre in machinery and buildings on large farms is about half that on the smaller farms. The increased efficiency of labour as size of enterprise increases is indicated by the fact that labour requirements are not much higher on the large farms than on the smaller farms. Through the use of large machines acreage can often be doubled without increasing the labour requirements of the enterprise. The effects of scale are also evident when comparing depreciation costs of small and large farms. Roughly quadrupling the size of farm (508 to 2,010 acres) resulted in depreciation costs only slightly more than twice such costs on small units. Economies of scale are also apparent in operating costs. The lower operating costs on large farms reflect more efficient use of fuel and lower repair costs of larger machines.

Another important feature of western grain enterprises is the low ratio of operating costs to gross income. This is partly the result of higher natural fertility of the Prairie soils and partly due to the greater efficiency of operations because of size of machines that can be used. Cash operating costs (fuel, repairs, hired labour, seed, fertilizer, etc.) can be covered with less than half of an average crop. This feature, along with the fact that some operating costs are lower in years of low yields, allows these enterprises to withstand several successive below-average crops. Capital replacements (machinery and buildings) tend to be high in high-income years. This results in deferred depreciation allowances in low-income years and aids, along with the above features, in making western grain farms much more stable, economically, than data on yield and net income variability would suggest.

The high levels of productivity and efficiency in grain production in western Canada are reflected in relatively high levels of income and a very favourable net-to-gross income ratio. Productivity in these enterprises continues to increase very rapidly. The new technology, now being adopted by western farmers, favours areas suited to large-scale enterprises. With both technology and resources so favourable, the comparative advantage in grain production in western Canada may be expected to continue to increase.

11. STRAWBERRY ENTERPRISE

Strawberries have been produced commercially in the Maritimes for many years. Until recently most of the production was absorbed by the local fresh market. In the past few years processing has become more important, and about 25 per cent of Maritime strawberry production was being utilized in this manner in 1966-67. An additional small proportion of the Maritime strawberry crop was exported fresh to markets in central Canada and the eastern United States.

The budget analysis of the strawberry enterprise was based on production for processing. The fresh market in the Maritimes is adequately supplied, at present, by local production largely within the borders of each of the provinces. Any expansion in strawberry production beyond the existing level would be mainly for processing or fresh export. The potential for fresh exports has not yet been firmly established, but the market for processing berries is reasonably dependable. If processing markets are profitable then the higher priced fresh markets should also be profitable. Furthermore, if fresh exports do expand, it is likely that a large proportion of the output of these enterprises will be processed.

The budget of the strawberry enterprise relied heavily on a recent study of this enterprise in Nova Scotia. 1/ Primary data from growers in the Maritimes and information from a number of published reports were used to supplement the information contained in the study and to adapt its data to the analysis technique used in this study.

The Nova Scotia study suggested that under existing conditions a grower selling half of his production on the fresh market and half for processing would require a minimum of seven acres of strawberries producing at the rate of 8,000 quarts per acre to achieve a net income of $4,000. Other studies have suggested that efficiency in strawberry production requires mechanization and that efficient use of specialized equipment cannot be achieved with less than seven to ten acres of strawberries.

In an enterprise where all of the fixed costs must be borne by one enterprise and where the crop is assumed to be sold for processing, 20 to 25 acres of strawberries may be necessary to achieve machine efficiency and satisfactory returns. The budget which follows was based on an enterprise with 20 acres of strawberries.

1/ Gervason, P., and R.S. Eaton, Economics of Strawberry Production in Nova Scotia, Nova Scotia Dept. of Agriculture and Marketing, 1967.

Strawberry production in the Maritimes accounts for about 19 per cent of the total in Canada and about 29 per cent of the total in eastern Canada. Average production in the Maritimes over the 1962-66 period was 4.9 million quarts (6.1 million pounds) (Table 11-1). Production is distributed fairly evenly among the three provinces with Nova Scotia producing about 40 per cent and the others about 30 per cent each. Production in Nova Scotia and New Brunswick has been mainly for the fresh market, while in Prince Edward Island 65 to 75 per cent is processed (frozen). In Nova Scotia and New Brunswick about 10 and 6 per cent, respectively, is processed. In total, about 25 per cent of Maritime strawberry production is processed. 1/

Strawberry enterprises in the Maritime provinces tend to be relatively small. In 1961 average acreage in strawberry enterprises was 2.0 acres in Prince Edward Island and 0.8 acres in both Nova Scotia and New Brunswick. Average bearing acreage was probably half these figures. Total strawberry acreage in the Maritimes was estimated at 1,942 acres in the 1961 Census. A recent study estimated bearing acreage in the Maritimes in 1964 at 805 acres (Prince Edward Island, 300 acres; Nova Scotia, 280 acres; and New Brunswick, 225 acres). The same study presented some data on size distribution of enterprises in Nova Scotia (Table 11-2). In 1965 only 4 per cent of the strawberry enterprises in Nova Scotia had more than 10 acres of strawberries. Average bearing acreage in these enterprises was 8.5 acres.

TABLE 11-1

Strawberry Production in Canada, by Province, 1962-66

	1962	1963	1964	1965	1966	Average
	thousand quarts					
P.E.I.	1,400	1,550	1,650	1,600	1,100	1,460
N.S.	1,800	2,000	2,200	2,000	2,100	2,020
N.B.	1,000	1,500	2,000	1,300	1,300	1,420
Maritimes	4,200	5,050	5,850	4,900	4,500	4,900
Québec	6,476	6,558	5,500	1,995	7,250	5,556
Ontario	5,989	4,501	7,995	7,581	7,273	6,668
B.C.	8,790	8,057	11,521	3,811	11,253	8,686
Canada	25,455	24,166	30,866	18,287	30,276	25,810

Source: Quarterly Bulletin of Agricultural Statistics, D.B.S. and Crop & Seasonal Price Summaries, Vol. 19, Part 1, 1965-66, Production and Marketing Branch, Canada Dept. of Agriculture, 1966.

1/ The estimates of strawberry utilization were obtained from the Maritime Berry Processing Industry, Food Products Branch, Canada Dept. of Industry, Ottawa, 1966.

TABLE 11-2

Distribution of Strawberry Enterprises

In Nova Scotia by Size, 1965

Size	Proportion of Enterprises	Average Area	
		New	Bearing
acres	%	------ acres -----	
1 - 3	73	1.0	1.0
3 - 5	14	2.1	2.0
6 -10	9	3.3	3.9
11 and over	4	7.0	8.5

Source: Maritime Berry Processing Industry, Food Products Branch, Canada Dept. of Industry, Ottawa, 1966.

TABLE 11-3

Average Strawberry Prices in Canada

By Provinces, 1961-65

	1961	1962	1963	1964	1965
	----------- cents per quart ------------				
P.E.I.	18	22	21	22	22
N.S.	23	24	23	25	26
N.B.	26	26	25	27	28
Québec	25	22	23	26	40
Ontario	22	23	24	26	30
B.C.	24	25	26	26	41
Canada	23	24	24	26	32

Source: Crop & Seasonal Price Summaries, Vol. 19, Part 1, 1965-66, Production and Marketing Branch, Canada Dept. of Agriculture, 1966.

Strawberry production in the Maritimes is not yet highly specialized although there appears to be a trend toward increased specialization. This lack of specialization accounts, at least in part, for the small average size of enterprises. The 1966 strawberry enterprise study in Nova Scotia which was concerned mainly with the larger producers found that this enterprise accounted for more than 50 per cent of gross farm receipts on only one-third of the farms included in the study.

Strawberry prices vary by province, year and according to use (Table 11-3). The average prices received by growers in the Maritimes over the 1961-65 period were 21 cents, 24 cents and 26 cents per quart in Prince Edward Island, Nova Scotia and New Brunswick. The higher prices in Nova Scotia and New Brunswick probably reflect the higher proportion of total production for the fresh market in these provinces as opposed to Prince Edward Island.

Budget Analysis of the Strawberry Enterprise

a) Basic Assumptions

1) Productivity - A yield level of 8,000 quarts per acre was assumed in the calculation of gross income and harvesting costs. Yields ranged from less than 3,000 quarts per acre to over 10,000 quarts per acre. A large proportion of the total output was obtained from the higher yielding enterprises. For example, in Nova Scotia in 1965 the provincial average yield was 5,500 quarts per acre, but 80 per cent of the production was accounted for by those growers who averaged 8,000 quarts per acre. About one-third of the growers contacted for the Nova Scotia enterprise study in 1966 reported first-year production levels of at least 10,000 quarts per acre.

2) Labour Force - It was assumed that a strawberry enterprise with 20 bearing acres and a high degree of mechanization could be operated by two men, i.e., an operator and one seasonal (May to October) hired man. Harvesting or picking labour was assumed to be hired on a contract or piecework basis.

3) Capital - The capital requirements of a strawberry enterprise consist mainly of land and equipment. The building requirement is minimal. Land in areas suited for strawberry production could generally be obtained for $100 per acre. An additional investment of about $20 per acre would probably be required to correct soil acidity. Installation of tile drainage would involve a further investment. This investment would range from $15 to $20 per acre for drainage of "wet spots" to $110

or more per acre for systematic drainage. 1/ It was estimated that the investment required for land would be about $135 to $140 per acre with minimum drainage.

The value of the machine complement required for a 20-acre strawberry enterprise was based on replacement costs for the various items. The total replacement cost of machines was estimated at $11,050 and average investment at $6,075 (55 per cent of new cost).

Item	Size or Type	Replacement Cost
Wiggle Hoe	Self-propelled	$ 2,000
Planter		350
Rota-vator		1,800
Straw Mulcher		900
Tractor	Small	3,000
Truck	Pickup	2,500
Sprayer		500
	Total	$11,050

Irrigation is considered essential in Maritime strawberry production. It is required for both spring frost protection and supplementary moisture in dry years. In some coastal areas, irrigation is not required for either frost protection or extra moisture but even there it is expected that future increases in strawberry acreage will require irrigation for consistent, satisfactory yields. An investment of $10,000 in irrigation equipment is considered adequate for an enterprise with 10 acres of bearing strawberries. The cost of equipment for an enterprise twice as large would likely be somewhat less than double the above figure. The new cost of irrigation equipment for a 20-acre enterprise was assumed to be 10 per cent lower on a per-acre basis than in a 10-acre enterprise, i.e., $18,000 in total. Average investment in irrigation equipment was estimated at $9,900. 2/

1/ The estimates of drainage costs are net costs to the farmer and do not include government assistance paid on tile drainage.

2/ The estimate of capital requirements for irrigation equipment does not include the cost of developing a suitable water supply for irrigation.

The total capital requirement for a strawberry enterprise with 20 bearing acres is indicated below:

Item	Replacement Cost	Average Investment
Land 1/	$ 8,100	$ 8,100
Equipment	11,050	6,075
Irrigation Equipment	18,000	9,000
Total	$37,150	$23,175

b) Enterprise Budget

1) Gross Income 2/

Strawberries	$32,000

2) Expenditures

Cropping Inputs 3/

Plants @ $86.40/acre	$ 1,728
Fertilizer and lime @ $97.50/acre	1,950
Spray materials @ $18.85/acre	370
Mulch @ $46.20/acre	924
Total	$ 4,972

Equipment

Tractor @ $33.60/acre	$ 672
Depreciation @ $42.28/acre	846
Total	$ 1,518

1/ Assumes a total land requirement of 60 acres: 20 bearing acres, 20 acres of new plantings and 20 acres in rotation crops.

2/ Twenty acres at 8,000 quarts per acre at 20 cents per quart. No estimate of revenue from rotation crops was included. It was assumed that costs and revenues of rotation crops would cancel each other.

3/ Based on the Nova Scotia enterprise study.

Irrigation Equipment

Maintenance @ $20.07/acre		$ 401
Operation @ $19.82/acre		396
	Total	$ 797

Hired Labour

Hired man - 6 months @ $250/month		$ 1,500
Extra planting labour		200
	Total	$ 1,700

Harvesting Costs 1/

160,000 quarts @ 8.5¢/quart	$13,600

Other Costs

Interest on operating capital @ 6% 2/		$ 400
Taxes @ 1.25% of total capital		301
Miscellaneous		200
	Total	$ 901

Total Expenditure $23,488

Per quart - 14.7¢

3) Net Income

i Net income of the basic enterprise.

Gross income	$32,000
Expenditure	23,488
Net income	8,512
Interest on capital (6%)	1,444
Labour income	7,068

ii Net income of the same enterprise at alternative yields and prices.

Yield	Price in Cents per Quart 20	22	24
(quarts per acre)	(dollars)		
6,000	3,912	6,312	8,712
8,000	8,512	11,712	14,912
10,000	13,112	17,112	21,112

1/ Based on the Nova Scotia enterprise study.

2/ Interest on cropping inputs and hired labour.

Appraisal of the Strawberry Enterprise

The budget analysis of the strawberry enterprise was based on production of fruit for processing. The analysis indicated that large enterprises can achieve satisfactory incomes under conditions of adequate supplies of relatively cheap seasonal labour and prices of 20 cents per quart or higher. The analysis was based on production for processing because it appeared that the potential for expansion lies mainly in the frozen, or otherwise processed, product. The fresh market was more profitable and in the Maritimes was well supplied in 1966 and 1967 by local production largely within the borders of each of the provinces. The potential for fresh exports was not favourable in the light of developments in competing areas, especially Mexico and California. In California, for example, where the production season is already five months long and fresh berries are being shipped to Europe as well as over most of North America the production season was being further extended. Yields there were reaching 24 tons per acre relative to about 6 tons per acre under good conditions in the Maritimes.

The main prospect for increasing production appeared to be the market for processed strawberries. In Prince Edward Island, strawberry processing was already fitted into the seasonal time sequence of crops passing through processing plants in that province in 1966 and 1967. In one processing plant in Prince Edward Island, this sequence of crops was as follows: spinach, strawberries, peas, cole crops and potatoes - thus permitting processing to be extended almost to a year-round operation.

To some extent the strawberry enterprise, like the blueberry enterprise, was dependent on the availability of a large supply of low-cost labour in the picking season. Unlike the blueberry enterprise, land suitable for strawberry production is more widely available and it can be located where the labour supply is more readily available. Moreover, the harvesting season occurs when labour in the form of school children is most readily available. However, like blueberries, this enterprise is likely to encounter continuing and possibly increasing difficulties in attracting the necessarily large seasonal labour requirements. In the past, such enterprises have relied on the relatively unskilled low-cost labour in rural areas where incomes were low and unemployment high. In future, as incomes rise and the population becomes more urbanized this supply of labour may be expected to decline, labour costs will rise and the resulting profitability of the strawberry enterprise will decline. This has occurred in other areas and is likely to occur in the Maritimes as well. Improvements in technology are unlikely to offset much of this prospective decline due to labour costs.

The potential for expanding output of processed strawberries in competition with imports from Mexico, Poland and the United States appears limited. A recent study by the

federal Department of Industry estimated prices that could be paid to growers if processed Maritime strawberries were to compete in various markets with imports. 1/ This study showed that at 16 cents per pound (20 cents per quart) the only major market available to Maritime processors was Montreal. At higher prices to growers no major markets appeared accessible.

1/ Maritime Berry Processing Industry, Food Products Branch, Canada Dept. of Industry, Ottawa, 1966.

12. BLUEBERRY ENTERPRISE

The Atlantic provinces, Québec and the state of Maine comprise the major lowbush blueberry area in the world. This area produces about 42 million pounds of blueberries annually. Maine produces about 53 per cent of this and the remainder is divided up roughly as follows: Québec, 17.0 per cent; Newfoundland, 5.0 per cent; Prince Edward Island, 0.7 per cent; Nova Scotia, 15.0 per cent; and New Brunswick, 10.0 per cent (Table 12-1). Blueberry production varies widely among provinces and by years. The production in Maine represented about one third of total United States production of blueberries (lowbush and highbush) and virtually all of the lowbush production. Within Canada, lowbush blueberries represented almost 90 per cent of total Canadian production and about 70 per cent of these are grown in the Atlantic provinces. This proportion varied substantially from year to year, mainly because of the wide fluctuations in production in Québec. Commercial production of lowbush blueberries in Québec ranged from about 3 million pounds in 1961 and 1965 to over 16 million pounds in 1966. Production in the Atlantic provinces in this period was more stable.

TABLE 12-1

Commercial Production of Lowbush Blueberries

In Eastern Canada and Maine,

1960 to 1966

Year	P.E.I.	N.S.	N.B.	Mari-times	Nfld.	Qué.	Eastern Canada	Maine
	------------------- thousand pounds							
1960	130	5,400	3,500	9.030	2,814	6,098	17,942	21,336
1961	451	5,700	4,500	10,651	2,934	2,715	16,300	25,550
1962	238	7,400	4,000	11,630	1,250	3,429	16,317	30,282
1963	150	7,000	4,000	11,150	1,401	8,551	21,102	22,795
1964	200	5,100	3,000	8,300	1,036	8,761	18,098	21,863
1965	240	7,000	2,500	9,740	2,264	3,081	15,085	10,607
1966	550	7,600	7,000	15,150	2,361	16,550	34,061	n.a.
Av.	280	6,457	4,071	10,807	2,008	7,026	19,844	22,072

Source: Lowbush Blueberry Production in Canada, Pub. 1278, Canada Dept. of Agriculture, 1967.

Within the Atlantic region, Nova Scotia and New Brunswick are the main blueberry producers. Over the 1960-66 period, average production of almost 13 million pounds per year was distributed as follows: Nova Scotia, 50 per cent; New Brunswick, 32 per cent; Newfoundland, 16 per cent; and Prince Edward Island, 2 per cent. About one third of the blueberries produced in Canada were exported fresh. A large proportion of these originated in the Maritime provinces and were sold fresh to United States buyers for processing. These fresh exports accounted for about 55 per cent of total Canadian blueberry exports. The balance of blueberry exports, also going to the United States, were shipped as frozen fruit. Most of the blueberries exported to the United States originated in the Maritimes.

Prices for blueberries vary widely from year to year (Table 12-2). Occasionally prices also vary widely among provinces in a given year. During the seven-year period from 1960 to 1966 prices in the Maritimes ranged from 8.5 cents per pound in Nova Scotia in 1962 to 25 cents per pound in New Brunswick in 1965. These prices reflect the annual variations in total production, quality and storage holdings of blueberries as well as the supply of competing products. There appears to be little difference, in any given year, between the prices paid for blueberries exported fresh and those processed locally.

TABLE 12-2

Average Farm Value of Blueberries

In Eastern Canada,

1960 to 1966

Year	Nfld.	P.E.I.	N.S.	N.B.	Qué.
	cents per pound				
1960	7.0	10.0	10.0	14.0	14.0
1961	8.0	12.0	9.0	9.0	11.0
1962	7.0	9.0	8.5	9.0	11.0
1963	7.5	13.5	12.0	11.0	10.5
1964	8.0	14.5	15.0	14.0	20.5
1965	28.0	16.0	23.0	25.0	29.0
1966	24.0	14.0	15.5	16.0	17.7

Source: Crop & Seasonal Price Summaries, Vol. 19, Part I, D.B.S.

The main blueberry areas in the Maritime provinces are in Cumberland county, Nova Scotia, northeastern New Brunswick, and Charlotte county, New Brunswick. In Nova Scotia about 12,000 acres were in production in 1966 and some additional acreage was under development. 1/ The producing area in northern New Brunswick has been estimated at 7,000 acres.2/ Blueberry acreage in Prince Edward Island has been estimated at less than 1,000 acres. Any significant expansion in blueberry acreage in the Maritimes would likely occur in Nova Scotia and New Brunswick since most of the potential blueberry land is located there.

Blueberry enterprises in the Maritimes range in size from only a few acres to over 1,000 acres. The majority are, however, in the smaller size categories as is indicated by the fact that the average size of enterprise in Cumberland county, Nova Scotia, in 1965 was about 28 acres. Bearing acreage is usually about half the total since the normal practice in the Maritimes is to burn half the acreage each year. No crop is produced in the year of burning.

In Nova Scotia blueberries are produced largely on privately owned land while in New Brunswick most of the blueberry land now in production and most of the potential acreage is Crown land. Estimates of land values in Nova Scotia ranged from as low as $20 per acre to as high as $200 per acre for some well-developed fields. In 1967, there was no reliable estimate of the average value of developed blueberry land. In New Brunswick, where blueberry lands are owned mainly by the Crown, growers paid royalties which varied with the yield.

Budget Analysis of the Blueberry Enterprise

a) Basic Assumptions - A budget analysis of any enterprise must rely on certain basic measures of physical inputs and outputs. These data were not well developed for blueberry enterprises. The budget which follows cannot be considered as reliable as might be desirable. Some estimates of yields, prices and production costs were obtained from personal field surveys, published reports and other sources, but these tended to vary widely among enterprises, years and sources. The blueberry budget used estimates obtained from these various sources and was based on the following assumptions:

1/ The Blueberry Industry: The role of ARDA, CR-No. 5, Dept. of Forestry and Rural Development, Ottawa, 1966.

2/ *Ibid*.

1) Productivity - Blueberry yields range widely by years, among fields and among enterprises. Yields range from a low of about 500 pounds per acre in underdeveloped areas to as high as three tons per acre on highly developed plots in good years. A more normal range is from about one-half ton to 1.25 tons per acre. The basic analysis assumed a yield of 1,500 pounds per acre. The effect of variations in yield was indicated in the calculation of net income.

2) Size of Enterprise - The budget was based on a 200-acre enterprise. Annual bearing acreage was assumed to be half the total, i.e., one-half of the acreage was picked each year and the other half was pruned by burning.

3) Labour Force - The budget for the 200-acre enterprise assumed that this scale of enterprise could be operated by one man with additional part-time and seasonal labour for spreading straw, burning and harvesting.

4) Capital - Estimates of land values range from $20 per acre to $200 per acre. In 1967, there were no reliable estimates of the average value of developed blueberry land. In northern New Brunswick where blueberry lands were owned mainly by the Crown, blueberry growers paid a royalty of $7.00 per acre at a yield level of 1,500 pounds per acre. If this could be interpreted as a rental charge, the average land value would be about $50 to $60 per acre. (This assumes a rental charge of 6 per cent on the toal acreage, half of which is in production each year.) The capital requirements for a 200-acre enterprise were estimated as follows:

Land - 200 acres @ $55	$11,000
Equipment 1/ ($9,000 replacement cost)	5,000
Total	$16,000

b) Enterprise Budget

1) Gross Income 2/

Blueberries - 100 acres @1,500 lbs./acre @ 15¢/lb.	$22,500

1/ Includes an oil burner, tractor, small truck, field cleaner, rotary mower, sprayer and picking equipment.

2/ Assumed one-half of the total acreage in production each year and the average price for the 1960-66 period.

2) Expenditures

Burning - 100 acres @ $18/acre	$ 1,800
Weed control - 100 acres @ $10/acre	1,000
Insect treatment - 100 acres @ $20/acre	2,000
Bee rental - @ 1 hive/acre @ $11/hive	1,100
Taxes - 1.25% of total capital	200
Machinery depreciation and operation - @ $5/acre	1,000
Miscellaneous - @ $5/acre	1,000
Harvesting - Picking @ 5¢/lb.	7,500
- Containers, etc. @ 0.5¢/lb.	750
Total Expenditure	$16,350

3) Net Income

i Net income of the basic enterprise.

Gross income	$22,500
Expenditure 1/	16,350
Net income	6,150
Interest on capital (6%)	960
Labour income	5,190

ii Net income of the same enterprise at alternative yields and prices.

Yield Per Acre	Price per Pound		
	10¢	15¢	20¢
(pounds)		(dollars)	
1,000	-3,600	1,400	6,400
1,500	-1,350	6,150	13,650
2,000	900	10,900	20,900

Appraisal of the Blueberry Enterprise

The budget of the blueberry enterprise was based on a 200-acre operation and assumed an average yield of 1,500 pounds per acre on one-half of the total acreage, an average price of 15 cents per pound and picking costs of 5 cents per pound. A change in any of these factors has a significant impact on the net income from a blueberry enterprise. These effects can be summarized as follows using the above assumptions as a base:

1/ The various items in the expenditure estimates may include some charges for operator labour and capital. The calculation of net income assumes that such was not the case.

1. Change of 500 pounds per acre in yield $4,750
2. Change of 5 cents per pound in price $6,500
3. Change of 1 cent per pound in picking cost 1/ $1,500

The profitability of blueberry production is highly dependent on the availability of low-cost seasonal labour. The blueberry areas are generally depressed low-income areas where unemployment is high and skills and education are low, hence the opportunity cost associated with this labour supply is very low. The budget analysis indicated that satisfactory incomes could be achieved from large enterprises (200 acres or more) if these conditions of adequate supplies of low-cost labour continued. If the problems of unemployment (total and seasonal), low levels of education and skill, etc., were overcome in these areas (which might mean a population shift out of the blueberry areas or an increase in wage rates, or both) the profitability of this enterprise would be reduced substantially. If this occurs, the future profitability and potential for expansion could well depend on the development of mechanized harvesters. These harvesters, if they can be developed, would likely work satisfactorily only on the better fields. This could result in substantial reductions in the estimates of potential blueberry acreage.

In assessing the potential for blueberry production it seems important to recognize two major factors. The first is the effect of a reduction of unemployment on picking labour costs. Under conditions in 1967, picking costs represented nearly half of total production costs. The second factor relates to the possibility of mechanizing the picking operation. The lowbush blueberry's main competitors on the market are highbush blueberries and cherries. Some progress has been made in mechanizing the harvesting operation of the latter fruits. Pressure for mechanization thus appears to be coming from two sources. The first is the rising labour costs for blueberry picking. The second is the increased competition resulting from mechanization of the harvesting operation of substitute products.

1/ Picking costs were reported at seven cents per pound in some areas in 1967. At this price level the net income of the basic enterprise would be reduced by about 50 per cent.

13. PROCESSING VEGETABLES

The main vegetables grown in the Maritimes for processing are peas, beans and cole crops (broccoli, brussels sprouts, cauliflower and spinach). The Maritimes, mainly Prince Edward Island, produce most of the processed cole crops in eastern Canada. The Maritimes are also major producers of frozen peas and beans (Table 13-1). A large proportion of the peas and beans processed in the Maritimes are frozen as compared to Québec and Ontario where the major proportions are canned. In the Maritimes about 80 per cent of the peas contracted for processing in 1966 were frozen as compared to only 2 per cent in Québec, 32 per cent in Ontario and 37 per cent in Canada as a whole. About half of the frozen peas and 40 per cent of the frozen beans produced in eastern Canada in 1966 were produced in the Maritimes. In terms of both frozen and canned products the Maritimes accounted for 17 per cent of the acreage of peas and beans in eastern Canada and 14 per cent of the total Canadian acreage in 1966.

TABLE 13-1

Acreage of Vegetables Contracted by Processors, Selected Provinces, 1966

	Maritimes	Québec	Ontario	Canada
	acres			
Peas - freezing	6,950	300	6,650	20,830
- canning	1,750	14,550	14,280	35,110
Beans - freezing	1,580	400	1,990	4,940
- canning	1,250	13,900	2,890	20,170
Broccoli*	520	-	-	710
Brussels Sprouts*	450	-	-	550
Cauliflower*	240	-	200	560

* All for freezing.

Source: Quarterly Bulletin of Agricultural Statistics.

Within the Maritimes, pea acreage was concentrated in Prince Edward Island and New Brunswick, cole crops were grown mainly in Prince Edward Island and beans were produced mainly in Nova Scotia (see Table 13-2 for acreages in Prince Edward Island). The acreages contracted for freezing and canning in the Maritimes reflect the differences among provinces in the processing methods used. In Nova Scotia, and more specifically the Annapolis Valley, where the main processing crop is beans, canning is the chief processing method. A large proportion of the canned peas produced in the Maritimes are also grown in Nova Scotia. In the other provinces the major proportions of the vegetables processed are frozen.

The dominant position of peas and cole crops in Maritime production of processed vegetables reflects climatic conditions there which are well suited to these crops. The cool moist weather in the summer months allows staggered plantings of peas, and as a consequence, a longer harvesting season and generally better quality than in areas where summer temperatures are much higher. Yields of peas in the Maritimes and central Canada are quite similar but quality is generally considered to be higher in the Maritimes. 1/

TABLE 13-2

Planted Acreages of Processing Vegetables

In Prince Edward Island, 1961-66

Year	Peas	Broccoli	Brussels Sprouts	Cauli-flower
	acres			
1961	956	70	95	31
1962	2,884	241	204	47
1963	2,980	363	293	80
1964	4,262	435	342	129
1965	4,384	367	188	220
1966	5,400	500	285	235

Source: Prince Edward Island Dept. of Agriculture.

1/ Average yields of peas reported by D.B.S. for the 1962-65 period were 2,500 pounds per acre in the Maritimes, 2,100 pounds in Québec, and 2,700 pounds in Ontario.

Cool, moist weather in the summer months and a relatively long autumn season provide the conditions under which good quality cole crops can be produced. Beans are, apparently, not a cool climate crop to the same extent that peas and cole crops are. This may be reflected in the concentration of beans in the Annapolis Valley where drier weather prevails and also in lower yields there than in Ontario and Québec. 1/

Peas, beans and cole crops are important items in the seasonal sequence of crops handled by processors in the Maritimes. These crops, along with potatoes and fruits, permit almost year-round processing in some plants. The following sequence of products is an example: spinach, strawberries, peas, broccoli, cauliflower, brussels sprouts and french-fried potatoes. Vegetables are normally processed over the period from late June to early November. In the winter months the main processed products are apples in Nova Scotia and potatoes in Prince Edward Island and New Brunswick.

Data on yields, costs and returns in the production of processing vegetables in the Maritimes were obtained from several processors (Table 13-3). All of the major processing crops grown in the Maritimes were included. Data on the production of processing peas in Ontario, Alberta, and New York are also presented for comparison purposes (Table 13-4). The data on cole crops suggest that relatively high profit margins can be achieved with these crops in the Maritimes. Net returns from beans also appeared favourable in areas where they can be grown successfully. 2/ With peas, net returns per acre are lower than with other vegetable crops in the Maritimes and similar to net returns obtained from the production of peas in other parts of Canada. The limited data that were available suggested that those vegetables which are climatically adapted to the Maritimes, in particular cole crops and peas, can be produced there in competition with other regions. More research is required, however, to indicate the extent of the competitive advantage of these crops in the Maritimes and the potential for expanding production for markets in Canada, the United Kingdom and elsewhere. Any research in this area on behalf of the Maritimes should give top priority to a more thorough analysis of the interregional comparative advantage in specific vegetables. This research should give particular attention to areas in the Maritimes, southern Québec, western Ontario and the irrigated areas in southern Alberta. These areas appear to have the greatest potential for competition in processing vegetable production.

1/ The average yields of beans in the Maritimes in the 1962-65 period was 2,800 pounds per acre as compared to 3,200 pounds in Québec and 4,500 pounds in Ontario.

2/ In some areas in the Maritimes the production of beans has been discontinued apparently because of the competitive advantage of producers elsewhere.

TABLE 13-3

Costs, Returns and Yields in Processing

Vegetable Crops in the Maritimes

	Peas	Beans	Broc-coli	Cauli-flower	Brussels Sprouts
Yields (T/acre)					
Average	1.5-1.75	2.8	3.0	4.5	3.0
Range - low	0.75	1.0	1.0	1.0	1.0
- high	3.0	8.0	7.0	9.0	7.0
Potential	2.0	3.0	5.0	7.0	6.0
Size of Enterprise (acres)					
Average	25	11	3	2	10
Production Costs ($/acre)					
Land rental	10-25	25	10	10	10
Seed or plants	30-40	35	5	10	20
Fertilizer	10-30	15	50	50	50
Chemical sprays	7-10	7	30	30	30
Machine costs	15-13	13	15	15	15
Labour (harvest)	-	-	120	110	-
Harvesting (custom)	30-35	77	-	-	100
Other	5-7	7	25	30	5
Total	107-160	179	255	255	230
Returns					
Gross ($/T)	85-100	90	135	100	100
Gross ($/acre)	128-175	252	405	450	300
Net ($/acre)	21-15	73	150	195	70

Source: Based on data from vegetable processors in the Maritimes.

TABLE 13-4

Costs, Returns and Yields in Processing Peas

In Ontario, Alberta and New York

	Alberta	Ontario (1961)*		New York
		Southwest	Central	
Yields (T/acre)				
Average	1.05	1.5	1.1	1.5
Size of Enterprise (acres)				
Average	53.8	17.0	10.5	35.0
Production Costs ($/acre)				
Land use	12.22	27.31	8.99	18
Seed	30.20	35.12	33.61	31
Fertilizer	4.13	11.80	7.21	17
Sprays	2.21	n.a.	n.a.	1
Machine costs	12.87	9.89	10.81	9
"Field" labour	5.46	5.64	6.33	6
Custom work	20.73	32.71	28.90	30
Other	2.24	0.66	4.83	7
Total	90.06	132.13	100.68	119
Returns				
Gross ($/acre)				
Grean peas	90.92	151.00	111.00	n.a.
Other ‡	13.45	n.a.	n.a.	n.a.
Total	104.37	151.00	111.00	n.a.
Net ($/acre)	14.31	28.00	10.00	n.a.

* 1961 data with costs updated to 1965.

‡ Seed, screenings and silage.

Source: Based on data from: Cost of Production in Agriculture, Pub. 65/22, Economics Branch, Canada Dept. of Agriculture, Ottawa, 1965; Farm Business Management, Ontario Dept. of Agriculture, Toronto, 1966; and Farm Management Handbook, A.E. Ext. 440, Cornell University, 1966.

14. GREENHOUSE VEGETABLE ENTERPRISE

Greenhouse vegetable production in the Maritimes is concentrated in Nova Scotia. In Nova Scotia the area under glass is much larger and increasing faster than in the other two provinces (Table 14-1). In 1964 Nova Scotia greenhouses accounted for almost 80 per cent of the area under glass in the Maritimes. More recent information indicates further expansion in greenhouse area in Nova Scotia since 1964.

The products produced in Maritime greenhouses include vegetables (tomatoes and cucumbers), cut flowers, potted plants and other products of lesser importance. In 1964 cut flowers accounted for 64 per cent of gross sales by greenhouses in the Maritimes. Vegetables accounted for 17 per cent. Sales by Nova Scotia greenhouses accounted for about three-quarters of the total sales by greenhouse operators in the Maritimes in 1964.

TABLE 14-1

Area Under Glass in the Maritimes, 1921 to 1964

Year	P.E.I.	N.S.	N.B.	Maritimes
	--------- thousand square feet			-------------
1921	7.8	141.8	60.5	210.1
1931	17.4	386.0	300.3	703.7
1941	3.4	345.7	160.7	509.8
1951	14.8	483.8	95.6	594.2
1961	28.9	646.0	268.3	943.2
1963	23.9	678.4	203.8	906.1
1964	25.6	864.9	217.8	1,108.3

Source: Census of Canada, Agriculture, 1961, and Greenhouse Industry, 1964, D.B.S., July 1966.

Vegetables account for a small, but increasing, proportion of greenhouse sales. Between 1963 and 1964, for example, sales of greenhouse vegetables increased about 60 per cent while sales of cut flowers increased about 24 per cent and potted plants, 7 per cent. Indications are that a large proportion of the increases in sales since 1964 have also been in vegetables. Tomatoes and cucumbers are the only vegetables of any significance in Maritime greenhouses. Tomatoes account for about 60 per cent of greenhouse vegetable sales in the Maritimes.

Nova Scotia greenhouse firms are not only more numerous - they are also much larger than elsewhere in the Maritimes (Table 14-2). The average greenhouse in Nova Scotia in 1964 was about twice as large as the average greenhouse in New Brunswick and more than three times as large as the average in Prince Edward Island. A size distribution of greenhouses based on 1961 county averages suggests that all of the enterprises with 20,000 square feet and over were located in Nova Scotia (Table 14-3). In this group the average area under glass was just under 40,000 square feet (0.9 acres).

Many of the commercial greenhouses which have been built in the last few years are relatively large. It is likely that greenhouses in the 20,000 square feet and over size category now account for a much larger share of all greenhouses than the 7.6 per cent they claimed in 1961. The average greenhouse in this category is likely over one acre in size.

TABLE 14-2

Number and Average Sizes of Greenhouses in the Maritimes, 1961, 1963 and 1964

	P.E.I.*	N.S.	N.B.
1961			
Number	11	69	39
Average Size (sq. ft.)	2,627	9,362	6,880
1963			
Number	6	38	23
Average Size (sq. ft.)	3,987	17,854	8,862
1964			
Number	5	53	25
Average Size (sq. ft.)	5,024	16,320	8,714

* 1963 and 1964 figures are for Prince Edward Island and Newfoundland combined.

Source: Census of Canada, Agriculture, 1961 and Greenhouse Industry, 1964, D.B.S., July 1966.

TABLE 14-3

Size Distribution of Greenhouses in the Maritimes by County Averages, 1961

Size	Distribution	
sq. ft.	no.*	%
2,000 or less	10	8.4
2,000 to 5,000	45	37.8
5,000 to 10,000	36	30.2
10,000 to 20,000	19	16.0
20,000 or more	9	7.6

* The number of firms reporting greenhouses in counties where the average size for the county was in the indicated size category. These averages were based on 1961 Census data.

a) Basic Assumptions - The assumptions underlying the budget analysis of a greenhouse vegetable enterprise are described below. The various estimates used were based on data from greenhouse operators in the Maritimes and from a number of published sources.

1) Products - The analysis was based on the production of two crops of tomatoes per year. Crop conditions, rate of growth, yields, length of harvest season, and other factors vary considerably for the two crops.

2) Productivity

Spring crop - 10 pounds per plant (60 tons per acre)
Fall crop - 5 pounds per plant (30 tons per acre)

Spring crop yields are about double fall crop yields. This is related to growing conditions, length of season, light and temperature conditions and other factors. The spring crop is usually harvested over a period from late April or early May to mid-August or to the time when outdoor tomatoes force prices down. The fall crop is harvested over a period from about the end of October to mid-December.

3) Size of Enterprise - The analysis was based on an enterprise with one acre under glass.

4) Labour Force - Estimates of labour requirements for greenhouses range widely. An Ontario study indicated that two full-time labourers plus additional help at peak labour demand periods could operate one acre of either tomatoes or cucumbers. 1/ These enterprises do not, however, grade and package their product. Information from Nova Scotia greenhouse operators indicates a labour requirement of about five men per acre for a complete operation including growing, harvesting, grading and packaging.

5) Capital Requirements - Estimates of capital requirements vary according to the size of the greenhouse, the type of materials used and the type of heating system used. The replacement cost of a one-acre glass greenhouse is estimated between \$1.60 and \$2.00 per square foot for the building (including header house) plus \$20,000 to \$30,000 for heating equipment, standby power and other equipment. Total replacement cost for a fully-equipped one-acre greenhouse for vegetables was estimated at between \$90,000 and \$115,000.

b) Enterprise Budget - The budget developed for the one-acre greenhouse on the basis of the above estimates of capital requirements, yields, labour requirements, etc., is presented below. Many of the estimates of costs are preliminary at this stage and some had to be based on only rough approximations for the location.

1) Gross Income 2/

Tomatoes

Spring crop - 60T @ 30¢/lb.		\$36,000
Fall crop - 30T @ 25¢/lb.		15,000
	Total	\$51,000

1/ Fisher, G.A., Report of Greenhouse Vegetable Production in Essex County for 1965, Farm Economics, Cooperatives and Statistics Branch, Ontario Dept. of Agriculture, 1966.

2/ The estimates of yields and prices were based on information from greenhouse tomato producers in Nova Scotia. Yields were estimated at 10 pounds per plant for the spring crop and 5 pounds per plant for the fall crop. Plant density was estimated at 12,000 per acre.

2) Expenditures

Cropping Inputs

Fertilizer and lime 1/		$ 900
Seed and plants 2/		125
Chemicals 3/		200
Miscellaneous 4/		1,000
	Total	$ 2,225

Labour

Five men @ $250 per month 5/	$15,000

Greenhouse Operation

Fuel 3/	$11,000
Power 3/	1,000
Water 3/	250
	$12,250

Buildings 6/

Depreciation		$ 5,000
Repairs		1,000
Insurance		500
	Total	$ 6,500

1/ Based on a yearly requirement of the equivalent of 6 tons of 18-18-18 or 20-15-20 at $114 per ton.

2/ Based on Ontario data.

3/ Based on estimates from greenhouse operators in Nova Scotia.

4/ Includes soil sterilization, plant bands, twine, mulch, etc.

5/ The labour force was assumed to consist of an operator and five men. No allowance for operator labour is included in this estimate.

6/ Average useful life was assumed to be 20 years, hence a depreciation rate of five per cent. Repair costs were estimated at one per cent of replacement cost.

Marketing Costs 1/

Packages @ 12¢/10 lb. bag		$ 2,376
Transportation @ 8¢/10 lb. bag		1,584
	Total	$ 3,960

Other Costs

Taxes 2/		$ 688
Miscellaneous 3/		500
	Total	$ 1,188

Total Expenditure	$42,123

Per square foot - 97¢

3) Net Income

i Net income of the basic enterprise.

Gross income	$51,000
Expenditure	42,123
Net income	8,877
Interest on capital (6%)	3,300
Labour income	5,577

ii Net income of the same enterprise on the basis of 1966 prices of 30.8 cents per pound for the spring crop and 28 cents per pound for the fall crop.

Gross income	$53,760
Expenditure	42,123
Net income	11,637
Interest on capital (6%)	3,300
Labour income	8,337

1/ Based on estimates from greenhouse operators in Nova Scotia.

2/ Based on 1.25 per cent of average investment. The rate is based on 1961 Census data for Nova Scotia.

3/ Includes telephone, business expenses, etc.

15. TOBACCO ENTERPRISE

In the 1960's considerable interest in tobacco production developed in the Maritimes, especially in Nova Scotia and Prince Edward Island. These two provinces appeared to have some land areas which satisfy the physical conditions (soil type, topography and climate) for the production of this crop. The acreage of tobacco grown in the Maritimes increased substantially in those years but in terms of total tobacco acreage in Canada it was still quite small. The 1966 Census reported 132,580 acres of tobacco in Canada as a whole. Maritime production was reported at 1,053 acres, less than one per cent of the total. Most of the tobacco produced in the Maritime region was grown in Prince Edward Island and Nova Scotia (Table 15-1). Present indications are that most of the potential tobacco acreage in the Maritimes is located in Prince Edward Island.

Most of the tobacco produced in Canada and all of that produced in the Maritimes is of the flue-cured type. This type is the main ingredient in Canadian cigarettes. Over the 1962-66 period Maritime acreage of flue-cured tobacco averaged only 0.7 per cent of the total for that type in Canada (Table 15-2). Because of lower yields in the Maritimes than in other areas the proportion of total output from the Maritimes was still smaller. The average yield in the Maritimes over the 1962-66 period was about 1,000 pounds per acre relative to about 1,750 pounds per acre in Ontario. The trend in yields was upward in all producing areas and particularly in the Maritimes. From 1962 to 1966 yields increased over 70 per cent in the Maritimes relative to about 18 per cent in Ontario and 23 per cent in Canada. Average prices over the five-year period were similar in all regions.

TABLE 15-1

Acreage of Tobacco in the Maritimes,

1961 and 1966

Year	Prince Edward Island	Nova Scotia	New Brunswick	Maritimes
	acres			
1961	100	69	17	186
1966	607	329	117	1,053

Source: Census of Canada, Agriculture, 1961 and 1966.

TABLE 15-2

Acreage, Yield and Farm Value of Flue-Cured Tobacco In Canada and Selected Provinces, 1962-66

	1962	1963	1964	1965	1966	Average
Canada						
Acreage (000)	122.4	105.8	79.6	93.5	124.1	105.1
Yield (lb./acre)	1,533	1,764	1,798	1,702	1,883	1,713
Farm Value (¢/lb.)	42.3	45.9	55.6	64.6	71.3	57.6
Québec						
Acreage	5,319	5,495	5,445	5,877	5,742	5,575
Yield (lb./acre)	1,241	1,038	1,065	741	1,366	1,087
Farm Value (¢/lb.)	47.2	49.1	54.9	61.9	71.4	57.4
Ontario						
Acreage (000)	116.6	99.5	73.5	86.9	117.5	98.8
Yield (lb./acre)	1,550	1,811	1,860	1,773	1,827	1,747
Farm Value (¢/lb.)	48.3	45.6	55.6	64.7	71.4	57.6
Other*						
Acreage	515	782	715	776	923	742
Yield (lb./acre)	726	830	1,059	1,028	1,255	1,007
Farm Value (¢/lb.)	42.0	47.5	56.7	59.1	67.8	57.6

* Indicated as "Other" in the source but refers to the Maritime provinces.

Source: Quarterly Bulletin of Agricultural Statistics.

Data which could be used for an appraisal of the comparative advantage in tobacco production in the Maritimes were not available in 1967. 1/ The main competing areas were in Ontario. Tobacco has been a profitable crop in Ontario for many years and will likely continue to be profitable (Table 15-3). Before any significant expansion is undertaken in the Maritimes an appraisal of the competitive conditions of tobacco production in Ontario should be made. This appraisal should recognize a number of factors which could affect the profitability and comparative position of this enterprise in the Maritimes. First, with higher yields in Ontario, production costs per acre would have to be substantially lower in the Maritimes to compete profitably with Ontario. Second, such an

1/ Some information is currently being developed in terms of bench-mark appraisals by the Farm Credit Corporation.

TABLE 15-3

Costs and Returns in Tobacco Production in Ontario

	Burley Tobacco		Flue Tobacco
	Average Income	High Income	Average Income
Production Information			
Average acreage	2.1	2.1	3.6
Yield per acre (lbs.)	2,171	2,426	2,093
Tractor input (hrs.)	34.3	32.3	n.a.
Labour input (hrs.)	377	377	335
Costs and Returns per Acre ($)			
Crop value	888	1,091	1,103
Operating costs	344	366	617
Fixed costs	441	419	n.a.
Total costs	785	785	n.a.
Margin over operating costs	543	725	486
Returns to risk and management	103	306	n.a.
Cost Detail per Acre ($)			
Land	33	33	n.a.
Buildings	93	90	n.a.
Materials - Plants	54	53	n.a.
- Fertilizer	60	60	)
- Manure	7	10	) 70
- Miscellaneous	19	21	)
Tractor	38	35	) 90
Machines	30	34	)
Labour	414	407	(Wages) 389
Miscellaneous	38	41	68
Total	785	785	n.a.

Source: Farm Business Management, Ontario Dept. of Agriculture, 1966.

appraisal should recognize the potential for expanded acreage in Ontario. In other words, is there additional suitable land available in Ontario for this enterprise? Third, such an appraisal should recognize differences in quality, yield variability, climate and other factors which result in differences in the risks involved in producing this crop in the two competing areas.

16. THE ENTERPRISE ANALYSIS IN SUMMARY

The broad objective of this study was to appraise the potential for agriculture in the Maritime provinces. Volume 1 of the Report examined the basic problems of the industry in the Maritimes, the resources available for expansion and the obstacles to adjustment. This volume, Volume 2, examines the comparative profitability of agricultural enterprises to provide an indication of the most profitable avenues for expansion in agriculture.

Comparative profitability of enterprises was examined on the basis of budget analyses of specialized enterprises. The enterprises analysed in the study comprised all of the major enterprise types in current Maritime agriculture and others which appeared to have some potential for growth. These enterprises included the following: dairy, beef, hogs, poultry, potatoes, tree fruits, strawberries, blueberries, feed grain, forage, processing vegetables and greenhouses.

The analysis of each enterprise was carried out in two main stages. The first or initial stage was based on an enterprise representative of existing enterprises and this initial enterprise was then enlarged into a second or "optimum" scale enterprise in which the size was limited to one in which specified objectives of income, leisure and social amenities may be attained. The expansion of the enterprise assumed managerial skills would improve and levels of productivity and efficiency would rise where warranted.

The initial-stage enterprises were structured on the basis of existing enterprises and certain selection criteria. One of these selection criteria was that the initial-stage enterprises should provide a <u>suitable and feasible basis</u> from which farmers would reasonably expect to expand to the optimum-scale enterprise. In general, this "suitable and feasible" condition necessitated using above-average-scale enterprises for the initial-stage analysis. This suitable and feasible criterion did not imply that the initial-stage enterprises were economic units providing both a satisfactory return on capital and an adequate labour income. They might better be considered as enterprises having sufficient collateral to qualify for a long-term loan which would allow for enough expansion to make the enterprise eventually viable and sound.

The second stage in the budget analyses of enterprises was concerned with the appraisal of expanded or "optimum" scale enterprises. These optimum-scale enterprises were designed to fulfill three main objectives to ensure that they provided satisfactory economic and social units. The three objectives were: (1) that the labour inputs of the operator be comparable to those in non-farm occupations; (2) that the operator's labour income be comparable to that obtainable in other occupations requiring similar levels of managerial and

technical competence; and (3) that the operator and his family have reasonably comparable access to normal social amenities. If physical and economic conditions in the Maritimes prevented a particular enterprise from achieving these objectives, that enterprise was considered unlikely to survive in the competition for higher incomes. Enterprises likely to fulfill the above objectives were considered in terms of their growth potential as determined by the availability and suitability of lands, markets, labour requirements, resource requirements of other enterprises and the like. An operator labour income of $6,000 was considered satisfactory for optimum-scale enterprises. This level of income was roughly equivalent to the average income of non-farm families in Canada in 1965.

For the budget analyses, specific locations were selected for initial application of the various enterprises. In general these locations corresponded to the areas where the particular enterprises are most concentrated in the respective provinces. The locations selected could be described as generally the "best" locations for the various enterprises in the respective provinces. In most cases the precise data necessary to make economic distinctions among locations within and between provinces in terms of physical productivity, land availability, land suitability and other factors were not available. One of the more pressing needs for a satisfactory appraisal of the agricultural potential of individual provinces and enterprises in the Maritimes is data which would indicate the extent and comparative productivity of these so-called "best" areas.

In general, the budget analyses indicated unsatisfactory incomes from the major land-using enterprises, i.e., dairy, beef and feed grain (Table 16-1). Satisfactory labour incomes were indicated for those land-based enterprises which were physically adapted to the Maritimes, i.e., potatoes, tree fruits, some processing vegetables, strawberries and blueberries. Some of these enterprises, however, owe their present profitability to the availability of low-cost seasonal labour in the region. The prospects for profitable expansion of potato production, for example, appear more favourable than for strawberries, blueberries and even tree fruits. The budgets for the non-land-based enterprises (hogs, poultry and greenhouses) indicated generally satisfactory labour incomes at average price levels.

TABLE 16-1

Capital and Labour Inputs and Incomes of Budgeted

Optimum-Scale Enterprises*

Enterprise	Capital (New Cost)	Labour‡	Gross Income	Net Income	Operator Labour Income
	$	no. men	$	$	$
Dairy (mfg.)	135,855	3.0	46,020	4,464	-1,380
Beef - Cow-calf	122,450	1.5	21,745	1,343	-4,657
- Feeder	125,400	1.5	120,115	-8,101	-13,201
Feed Grain	134,300	1.5	29,549	6,230	-370
Hogs - Conventional	76,300	2.0	70,090	6,213	3,485
- Weanling	96,000	2.0	46,400	4,098	498
- Feeder	70,000	2.0	164,273	9,418	7,108
Poultry - Laying	54,000	2.0	117,491	12,202	10,422
- Broiler	75,000	2.0	100,800	6,752	4,277
Potato - N.B.	105,900	2.0	45,948	12,670	8,470
- P.E.I.	151,900	2.5	66,969	19,792	13,012
Tree Fruits	106,550	1.5	40,000	12,768	7,278
Strawberries	37,150	1.5	32,000	8,512	7,068
Blueberries	20,000	1.0	22,500	6.150	5,190
Greenhouses	100,000	6.0	51,000	8,877	5,577

* The estimates of capital investment,labour force and income refer to the budgets for the basic analysis of each enterprise. Interprovincial differences in product prices, input prices, yields, marketing costs, premiums and other factors are not reflected here. Information on processing vegetable and tobacco enterprises were not included because data were not available to develop complete budgets on bases similar to the other enterprises.

‡ Does not include piecework or contract labour for tasks such as grading and packing potatoes, picking apples and strawberries, grading and packing eggs, etc.

Dairy and Beef

The budget analysis of dairy and beef enterprises indicated that enterprises which rely heavily on hay, grass silage, pasture and purchased concentrates are unlikely to provide satisfactory labour incomes at average product prices. Labour incomes appear satisfactory in fluid milk enterprises, for which milk prices are generally high enough to carry the high cost of feed. However, at manufacturing milk prices of less than about $4.50 per cwt. it appears unlikely that satisfactory incomes can be obtained even if one assumes a labour force smaller than that considered necessary to achieve the labour and social objectives of optimum-scale enterprises.

The relatively high cost of producing forages and the relatively high prices for purchased concentrates in the Maritimes also limit the profitability of beef enterprises. At average price levels for beef it appears unlikely that specialized beef enterprises based on a grass and grain feeding program will be profitable in the Maritimes. On the other hand, if corn silage can be produced successfully on a large scale without excessive capital investment or yield variability there may be some hope for beef production in the Maritimes. The economic feasibility of production of corn silage for this purpose should be examined on a practical large-scale farm basis where the economic effects of the physical conditions can be fully appraised. Whatever the profitability of beef production in the Maritimes using corn silage it should be noted that corn-silage feeding in other regions will likely be more profitable partly because of higher productivity and partly because of physical environment. Nevertheless, if it is at all profitable, it may have a comparative advantage over some of the other land-based enterprises within the Maritime region. Such enterprises will undoubtedly be less profitable than fluid milk, potato and a few other enterprises and will not be able to compete for the land most suitable for these enterprises. The location and extent of suitable land outside these areas was not well defined at the time of this study. The limited physical data available on land resources suggested that Prince Edward Island had the largest acreage of land suitable for production of corn silage.

Feed Grain

The budget analysis of the feed grain enterprise indicated that specialized grain enterprises were not likely to provide satisfactory incomes for Maritime farmers. In western Canada grain enterprises with capital and labour inputs similar to the budgeted Maritime enterprise indicated operator labour incomes of about $10,000. The general unprofitability of grain production in the Maritimes was evident from the existence of few, if any, farms which relied on grain as the major source of income. Limitations of climate, soil

and topography made specialized grain production relatively costly and risky in that region. Yet it may have good potential as a supplementary enterprise on potato and certain other types of farms. In Prince Edward Island, grain production in combination with large-scale hog enterprises seemed to offer possibilities for profits. These possibilities were related to the difference between the price received by grain producers and the price paid to feed suppliers and might thus be temporary. Such potentials for grain were limited to the land areas suitable for grain production outside those used by potato and fluid milk enterprises.

Hogs

Budgets for hog enterprises indicated that hog production in the Maritimes was marginally profitable at a mainland price (Halifax and Moncton) of $30 per cwt. for Grade A hogs. The operator labour incomes of 100-sow conventional enterprises at this price ranged from about $3,500 to $6,600 among the three provinces. Premiums on Grade A hogs accounted for up to 80 per cent of the labour income at the lower end of the range. Furthermore, freight assistance on imported grains amounted to more than the total net income of this enterprise. (With freight assistance at $15 per ton the total freight subsidy for a 100-sow conventional enterprise based on imported grains was about $8,200.)

Hog production was much more profitable in other regions than in the Maritimes. In other regions, however, several other enterprises appeared more favourable in terms of profits, labour inputs or other factors. This suggested that so long as these other enterprises retained their comparative advantage over hogs in these regions, hog production could be expanded in the Maritimes for the local market provided the established hog quality premiums and feed freight assistance remained. However, with the outlook in 1968 for lower prices and reduced export sales of wheat from Canada this situation could change rapidly. Hog production could increase in western Canada to the point where prices are driven down to levels where it would no longer be profitable in the Maritimes.

Despite these uncertainties, hog production based on grain produced as a rotation crop on potato farms in the Maritimes seemed likely to continue to be a profitable complementary enterprise. There also appears to be some scope for combined hog and grain operations. Prince Edward Island appears to have larger acreages of land suitable for grain production than either New Brunswick or Nova Scotia and appears, therefore, to have the greatest potential for expansion in hog production.

The budget analysis of poultry enterprises indicated that these enterprises could compete successfully with enterprises elsewhere for the Maritime market. Evidence of this ability was found in the fact that the Maritimes already produced virtually all of their egg and poultry meat requirements. Production costs were slightly higher in the Maritimes for both broilers and laying enterprises, but the difference was about equal to the cost of transporting eggs and poultry meat from competing regions to the Maritimes. These enterprises relied heavily on imported feeds and their continued profitability was dependent on the availability of freight-assisted grains.

Potatoes

The budget analysis of potato enterprises indicated these to be the most profitable enterprises in the Maritimes. Satisfactory returns were indicated in budgets based on the production of table stock potatoes. Higher returns than this could be expected from potatoes sold for seed and processing. On table stock production, Prince Edward Island enterprises appeared to have some advantage over New Brunswick based on lower shrinkage rates and higher average prices. On processing and seed potatoes the profitability of enterprises in both provinces appeared similar. With these latter two products shrinkage rates were similar in the two provinces and the price differential was smaller. Higher average yields in New Brunswick further reduced the advantage of Prince Edward Island in processing and seed potatoes.

Comparison of potato enterprises in the Maritimes with those in Ontario suggested that efficient Maritime enterprises would continue to compete well in central Canada markets. This competitive ability was related to higher yields, better quality, and lower production costs in the Maritimes. In addition, in Ontario competition from other cash crops tended to reduce the comparative advantage of potato enterprises, as reflected in rapidly rising land costs. Comparison of existing "average" enterprises in Prince Edward Island and New Brunswick indicated substantially greater capital requirements for storage facilities, machinery, farm consolidation, etc., in Prince Edward Island than in New Brunswick if equally efficient enterprises are to be developed in both provinces.

The potential for expansion in potato production in the Maritimes was related primarily to increases in demand in areas outside of the Maritime region. For Maritime producers this increase could come from three sources; population increase in central Canada, a larger share of the domestic market and increased exports. New Brunswick and Prince Edward Island had virtually the entire seed export market for Canada and if their quality could be maintained their advantage would likely continue. Table stock exports and exports of processed

potato products from Canada also originate mainly in the Maritimes. Maritime producers and processors should be able to capture a large proportion of any export expansion in these products. All of these aspects of the potato market (seed exports, domestic and export table stock markets, and domestic and export markets for processed potatoes) need further study and analysis before the potential for expansion in Maritime potato production can be fully and satisfactorily appraised.

Tree Fruits

The budget analysis of tree fruits enterprises indicated satisfactory incomes from optimum-scale enterprises in the Maritimes. Apple enterprises based on production of supplies for processing and for the fresh apple market appeared profitable at average price levels. Due to some deficiencies in the quality of fresh apples produced in the Maritimes it appears likely that fresh apple production will be restricted largely to local markets. Any expansion in apple production in the Maritimes will be based mainly on the possibilities for increased exports of processed apples out of the region. Lower production costs in the Maritimes suggest a comparative advantage in the production of apples for processing. A satisfactory estimate of the potential for expansion is, however, not available at this time. A competent market research study would be required to establish this. Particular attention should be given to evaluating the effects of the recent sterling devaluation on the profitability of Maritime tree fruits production. This could have serious repercussions for Maritime apple production since about half of the apples produced were shipped to sterling markets. The impact of this devaluation is similar in effect to a reduction in the price of apples. For example, a 10-per-cent reduction in the average producer price for apples would decrease the labour income of the budgeted optimum enterprise by about 55 per cent.

Strawberries

Available data indicated satisfactory returns from large-scale strawberry enterprises in the Maritime provinces under conditions of above-average yields, availability of seasonal labour for picking and prices of 20 cents or more per quart for processing strawberries. Expansion in strawberry production must be based largely on exports out of the region either as fresh fruit or processed products since local markets are already well supplied with strawberries produced in the Maritimes.

The profitability of strawberry production is dependent, to a large extent, on the availability of a large, seasonal labour supply for harvesting. As incomes and employment rise and as the population of the region becomes more

urbanized the cost of this labour is likely to rise and adversely affect the profitability of this enterprise. This factor must be taken into consideration in any assessment of the potential for increasing strawberry production for fresh or processed exports. Maritime producers faced stiff competition from other regions in both of these markets and this suggested only limited profitability for Maritime enterprises based on production for export. A fully satisfactory appraisal of the potential for expansion in strawberry production would require some additional market research. Such research should recognize that any markets which may exist or are developed are not the exclusive preserve of any one province in the Maritimes; hence any plans for expanded output in one province must take into account developments in other provinces in the region.

Blueberries

The profitability of blueberry production was highly dependent on the availability of low-cost seasonal labour. Under conditions of adequate supplies of this labour, satisfactory incomes could be achieved from large enterprises. However, if the low-income problems of unemployment, low levels of education and skill, etc., were overcome in the areas where blueberries are produced it is likely that the profitability of this enterprise would be reduced substantially.

A fully satisfactory appraisal of the blueberry enterprise requires better physical production data than are currently available and some further market research to appraise the potential demand for blueberries and blueberry products. Such research should pay particular attention to technological developments associated with competing products such as highbush blueberries and cherries.

Processing Vegetables

Data from vegetable processors in the Maritimes indicated that those vegetables which are climatically adapted to the region can be produced profitably in competition with other areas. Cole crops (brussels sprouts, cauliflower and broccoli) and peas appeared to be the main vegetables in which Maritime producers have a competitive advantage. They were already major suppliers of these vegetables in eastern and central Canada markets. There appeared to be significant potential for expansion in production of these crops, especially in Prince Edward Island and western New Brunswick where physical conditions were particularly favourable. More research is required, however, to indicate the extent of the competitive advantage of these crops in the Maritimes and the potential for expanding production for markets in Canada and elsewhere. Processing vegetables appeared likely to continue to be fairly profitable supplementary enterprises for Maritime farmers.

Greenhouse Enterprise

The budget analysis of greenhouse enterprises examined the profitability of greenhouse tomato production. In the Maritimes, greenhouse vegetable production (mainly tomatoes and cucumbers) was concentrated in Nova Scotia. The expertise required for the operation and management of greenhouses had been developed there, hence it seemed likely that further expansion in greenhouse vegetable production would occur mainly in that province. Greenhouse tomato production appeared to be a relatively profitable enterprise and considerable scope for expansion was indicated. It was unlikely, however, that Maritime production could be expanded beyond the requirements for the Maritime market in competition with producers in other areas.

Further Research

In the course of this study and in discussions with those concerned with policy and programs the question of the application of these enterprise analyses to the development of Maritime agriculture has frequently arisen. A completely satisfactory answer to this question would require much more data than are now available and considerable research beyond the scope of this study. More specifically, this question needs to be examined in the light of: (1) research which would indicate more clearly the area and suitability of land for particular enterprise types in the Maritimes, (2) comparative data on physical productivity among areas within the Maritimes and between the Maritimes and other regions, (3) comparative advantage of particular enterprises in other regions, (4) regional and export market potential for particular products, (5) the continued sharp decline of the many small enterprises in the Maritimes and (6) other related considerations. With the additional information which such studies would provide, it would be possible to project more precisely the future potential and probable trends for each type and scale of enterprise and, from this, the likely number of each enterprise type and scale that may be expected to be operating at various dates in the future.

As it stands now, it may be possible to estimate roughly, for example, the number of optimum-scale hog enterprises needed to satisfy the consumption requirements of the Maritime market. (This must assume an overall comparative advantage for optimum-scale hog production in the Maritimes and implies the elimination of all small hog enterprises. The value of an estimate which must be based on such extreme and doubtful assumptions is very questionable.)

About 140 to 150 optimum-scale hog enterprises (100-sow conventional enterprises) would be required to produce the number of hogs which were slaughtered in inspected establishments in the Maritimes in 1966. There were 7,849 hog enter-

prises in the Maritimes in 1966. These supplied about half of the Maritime requirement for pork. To supply the whole Maritime market with pork produced in the region would require a doubling of hog production or, in total, about 300 of the above optimum enterprises. Whether or not hog production in the Maritimes could or would be expanded in this way or even maintained at its level of 1967 was not certain at the end of 1967. The hog potential was related to several factors: (1) probable changes in the comparative advantage of hog production in other regions - hog production was already more profitable in some regions than in the Maritimes; (2) the continuation of freight subsidies on imported grain; (3) the continuation of quality premiums on Grade A hogs; and (4) the possibilities for expanded hog production in the Maritimes based on local production of feed grains.

Estimating the possible number of optimum-scale potato enterprises in the Maritime provinces seems equally fruitless. To produce the average volume of potatoes produced in Prince Edward Island and New Brunswick over the 1962-66 period would require about 235 enterprises of optimum scale in Prince Edward Island and 380 enterprises in New Brunswick. In 1966, 4,515 farms in Prince Edward Island and 5,471 farms in New Brunswick reported potatoes. Since potato production in the Maritimes has become more specialized and more highly mechanized and is profitable, it appears likely that a major proportion of the total output of potatoes will be produced by the relatively large enterprises. There is not enough information on which to base the measurement of the number of enterprises required for a total output greater than the present production. Such a measurement would require a more comprehensive assessment of the potential market for Maritime potatoes than is now available.

These two illustrations indicate that, in a general study of this nature, the estimation of the numbers of optimum-size enterprises of each type may be of doubtful value. Only with more specialized study of all market and other considerations related to each type of enterprise can such estimates be usefully made. Such specialized follow-up studies are strongly recommended, especially for potatoes, tree fruits, hogs, processing vegetables, greenhouses and small fruits.

APPENDIX TO CHAPTER 8

ENTERPRISE ANALYSIS TECHNIQUES, POTATOES

This Appendix provides an illustration of the manner in which data were gathered and budgets developed for various enterprises. This technique was used with many of the enterprises with varying degrees of success. The example presented here demonstrates what can be achieved with this technique. It also indicates the high level of competence of some farmers in the Maritime provinces. It suggests that a considerable amount of useful information is available from these specialized farm operators and illustrates the need for competence among those people who are conducting economic research in agriculture in the Maritimes.

The sequence of steps taken in developing the potato budgets illustrates the techniques. The preliminary budget which follows was based on data gathered on field trips to the Maritimes and from several published sources. This budget along with a list of specific questions was then sent to Mr. E.K. Lewis of Freetown, Prince Edward Island for review and comments. Mr. Lewis is highly regarded among knowledgeable people in the potato industry. (The fact that he was asked to present a paper on potato production costs at the Canadian Potato Industry Conference at Acadia University in 1966 is evidence of this.) Mr. Lewis' comments on the preliminary budget and the questions posed are, with his permission, quoted directly from his reply to our request.

The preliminary budget and list of questions which were sent to Mr. Lewis follow:

Preliminary Budget for a Prince Edward Island Potato Enterprise

The budget analysis was based on the following assumptions:

1) Size of Enterprise - 150 acres of potatoes and 300 acres of total cropland.

2) Productivity - A yield level of 140 barrels per acre (230 cwt.) was assumed. This is 20 per cent above the 1962-66 average for Prince Edward Island. Production of table stock potatoes was assumed.

3) Labour Force - Operator
- One year-round hired man
- One seasonal hired man
- Labour for harvest, set-cutting, grading and loading, etc.

4) Cropping Program - Potatoes - 150 acres
Forage - 75 acres
Grain - 75 acres

5) Capital

Land - 300 acres @ $150 per acre	$45,000
Buildings - Storage 1/	17,500
- Other 2/	5,500

Equipment

Tractor 50-60 H.P.		$ 7,300
Tractor 40 H.P.		5,000
Plow		1,000
Disc		500
Drill		1,350
Harrow		300
Set-cutter		2,000
Planter - 2-row		1,800
Cultivator - 4-row		650
Sprayer - 10-row		1,600
Trucks (used) with bulk boxes		4,500
Harvester		10,000
Bin Piler		2,000
	Total	$38,000
Average investment 3/		$20,900
Total capital		$88,900

1/ Storage capacity for 20,000 barrels @ $1.75 per barrel replacement cost. Average investment was estimated as one-half the replacement cost.

2/ Included housing for hired labour and buildings for equipment and supply storage.

3/ Average investment for equipment was estimated at one-half replacement cost plus 10 per cent salvage value.

The budget for the potato enterprise follows:

1) Gross Income

Potatoes 1/		$63,963
Grain 2/		5,625
Cull potatoes 3/		1,000
	Total	$70,588

2) Expenditures

Cropping Inputs

Fertilizer - Potatoes 4/		$ 8,550
- Grains 5/		1,005
Seed - Potatoes 6/		6,000
- Grain and Forage 7/		581
Spray Materials - Potatoes 8/		1,800
- Grain - custom $2/acre		150
Other - Lime and other inputs		1,125
	Total	$19,211

Labour 9/

Hired man - year-round		$ 3,000
Hired man - seasonal		1,500
Extra harvest labour		720
Set-cutting		338
Grading and loading		4,200
	Total	$ 9,758

1/ 150 acres at 230 cwt. per acre less 15 per cent shrinkage at $2.06 per cwt.

2/ 75 acres at 1.5 tons per acre at $50 per ton.

3/ 2,000 barrels at $0.50 per barrel.

4/ 150 acres at 1 ton of 6-12-12 per acre at $57 per ton.

5/ 75 acres at 400 pounds of 10-10-10 per acre at $67 per ton.

6/ $40 per acre.

7/ Grain - 75 acres at $2.75 per acre; Forage - 75 acres at $5 per ton.

8/ 150 acres at $12 per acre.

9/ Regular hired labour at $250 per month, extra harvest labour at $12 per day, set-cutting at $2.25 per acre, and grading and loading at 20 cents per barrel.

Machinery and Equipment

Tractors 1/ - Large 900 hours @ $1.55/hr.		$ 1,395
- Medium 700 hours @ $1.15/hr.		805
Trucks - Depreciation, fuel, repairs, licence and insurance		1,350
Cropping and harvesting equipment 2/		2,415
	Total	$ 5,965

Buildings 3/

Depreciation		$ 2,650
Repair		460
Insurance		154
	Total	$ 3,264

Other Costs

Custom-combining @ $6/acre	$ 450
Taxes 0.8% of land and building investment	544
Interest on seed and fertilizer	484
Miscellaneous	900
	$ 2,378

Total Expenditure	$40,576

Per 75 lb. bag - $0.98

3) Net Income

i Net income of the above enterprise.

Gross income	$70,588
Expenditure	40,576
Net income	30,012
Interest on capital (6%)	5,334
Operator labour income	24,678

1/ Included depreciation, repairs, lubricants and fuel and insurance.

2/ Depreciation and repairs on equipment other than tractors and trucks.

3/ Building depreciation was based on a 15-year life for potato storage buildings and 20-year life for other buildings. Repairs were estimated at 1.0 per cent of replacement costs.

ii Net income of the same enterprise on the basis of the 10-year average price of $1.86 per cwt.

Gross income	$64,378
Expenditure	40,576
Net income	23,802
Interest on capital (6%)	5,334
Labour income	18,468

Questions Pertaining to Potato Production in Prince Edward Island

1. Size of Enterprise - The budget was based on a specialized potato farm with 150 acres of potatoes.

   Would you consider this an economic-sized unit in terms of labour efficiency, capital efficiency, etc.?

2. Size of Farm and Cropping Program - The budget assumed 150 acres of potatoes and 300 acres of total cropland. The cropping program was assumed as follows:

Potatoes	-	150 acres
Grain	-	75 acres
Forage	-	75 acres

   Under the conditions which prevail in Prince Edward Island, are these assumptions regarding the intensity of production (50 per cent of cropland acreage in potatoes) reasonable?

3. Yields - Is the yield estimate of 140 barrels per acre (230 cwt.) consistent with the cropping program assumed? Marketed yield of table stock potatoes was assumed to be 10 per cent lower than this, that is, shrinkage was assumed at 10 per cent.

4. Capital Requirements - Are the estimates of land value and machinery and building costs reasonable? The estimate of building investment does not include the farm operator's house.

5. Labour Force - The budget assumed a labour force of an operator, one year-round hired man, plus piecemeal labour for grading and loading, set-cutting and harvesting. The wage rates and amounts of labour hired are indicated in the budget.

   Are the estimates of total labour requirements and wage rates reasonable?

6. Do you have any comments relating to the estimates of costs for individual items, in particular fertilizer, seed, spray materials and equipment costs? Have any significant cost items been omitted?

7. The estimate of gross income includes grain and cull potatoes.

   (a) Are the estimates of grain yield and price reasonable? Grain is assumed to be sold at harvest time.

   (b) Shrinkage was estimated at 10 per cent. This compares with average shrinkage of 15 per cent for table stock and seed potatoes in Prince Edward Island from 1961-65. Are these cull potatoes marketed or dumped in a typical operation? In other words, should they be included in the estimate of gross income?

8. Comparison of potato production in Prince Edward Island and New Brunswick.

   Do you have any comments regarding comparative yields, quality, production, costs, etc., in the two provinces?

Mr. Lewis' comments and the revised budget prepared by him are presented below:

1. <u>Size of Enterprise</u>

I would answer this question by simply saying "yes".

2. <u>Size of Farm and Cropping Program</u>

These assumptions are reasonable if all things work out as planned. But supposing an infection of Bacterial Ring Rot or any other contagious infection is experienced. It follows that you cannot grow potatoes on the previous year's potato ground. Your rotation shows that the grower would have to repeat one-half of the previous year's potato ground each year. Also, there is danger of scab condition of tubers on repeated potato ground especially in a dry growing season. I would therefore have to say that if this were my operation I would have 450 acres to operate economically and efficiently.

3. <u>Yields</u>

I would say that the estimated yield is consistent with the growers of 100 acres and up, although as you say the average is 20 per cent lower than this for Prince Edward Island. You may find this difference in yield versus graded potatoes. The shrinkage is about average, but from here you assume that the balance is Canada #1 salable potatoes. You have not taken into consideration the smaller size potatoes, that is, the seconds, which are worth only 70 cents per cwt. We find that average is about 15 per cent of the yield.

4. <u>Capital Requirements</u>

In the past land value was about $100 per acre, then rose to $150 per acre, until today to buy good productive land, $200 per acre must be paid.

Building costs depend on whether you build one large storage or two or three smaller ones. When you build large storages, which the case should be, you have a greater demand on temperature and humidity controls, thus the costs would be much higher than you have estimated. However, with very careful management your building estimates are adequate. (Machinery costs will be covered in Question 6.)

5. Labour Force

I might say here that seasonal labour is becoming more difficult to hire each year. It is almost to the place where the operator has to maintain a full crew of men the year round in order to maintain an efficient operation. But from the standpoint of economics, this presents a problem. This does tend to increase the acreage of potatoes per farm unit. I would suggest from my own observations that the total labour cost is about 20 per cent low.

(a) You should and need to have two year-round men. This would cost an additional $1,500 per year.

(b) Digging costs an average of $12.00 per acre for labour. This would be another additional cost of 12 x 150 = $1,080. The other labour costs are approximately correct.

6. Costs for Individual Items

The fertilizer costs are in line. Of course, there can be variations due to the different analysis used. Seed costs are really difficult to determine due to the inconsistent price of potatoes. The estimated $40 to $50 is correct. The other seed costs are in order.

Equipment costs: I find your estimates and mine differ here.

Item	Your Cost	Actual Cost (Approx.)	Diff.
Plow	$1,000	$1,500	$ 500
Disc	500	1,000	500
Sprayer (10 row)	2,000	4,000	2,000
3 trucks ($1,000 each)) 3 bulk boxes (1,000 each))	4,500	6,000	1,500
Escalators (2 @ $450 each)		900	900
Weighing scales (2 @ $250 each)		500	500
Grading equipment		2,000	2,000
Misc. will cover any others			
			$7,900

The insurance will cover building but not the crop while in storage - $350.00.

7. (a) Assuming you grow barley the average yield I have reaped is 45 bushels per acre. In 1967 the average per acre was 32.5 bushels. The price payable for barley is approximately $2.25 per cwt. This would indicate your estimates double the actual grain returns.

(b) Your shrinkage estimate on potatoes is in line, but as to value, unless you have cattle or hogs they are dumped. I have never heard of 50¢ a barrel but know of culls being sold for 10¢ a barrel or just being given away to avoid cost of dumping.

8. In comparing potato production in Prince Edward Island and New Brunswick I would believe there is not too great a difference in general. However, New Brunswick's unit acreage is considerably higher than Prince Edward Island's. This would tend to cut costs per acre. Prince Edward Island, on the other hand, has a better geo-physical area to grow potatoes. Lighter soil, absence of gravel and stone enables us to use big harvesters more easily. Prince Edward Island's geographical location creates hardships in reaching sizable markets.

Budget for a Prince Edward Island Potato Enterprise

1) Size of Enterprise - 150 acres of potatoes and 450 acres of total crop land.

2) Productivity - Same.

3) Labour Force - Operator
   - Two year-round hired men
   - Labour for harvest, set-cutting, grading and loading, etc.

4) Cropping Program - Potatoes - 150 acres
   - Grain - 150 acres
   - Forage - 150 acres

5) Capital

Land - 450 acres @ $200 per acre	$90,000
Buildings - Storage	17,500
- Other	5,500

Equipment

Tractor 50-60 H.P.		$ 7,300
Tractor 40 H.P.		5,000
Plow		1,500
Disc		1,000
Drill		1,350
Harrow		300
Set-cutter		2,000
Planter - 2-row		1,800
Cultivator - 2 row		650
Sprayer		4,000
Trucks		6,000
Harvester		10,000
Bin Piler		2,000
Escalators (2 @ $450 each)		900
Weighing scales		500
Graders		2,000
	Total	$46,300
Average investment		$25,465
Total capital		$138,465

The budget for the potato enterprise follows:

1) Gross Income

Potatoes 1/		$57,474
Potatoes 2/		2,205
Grain 3/		7,290
Cull potatoes 4/		200
	Total	$67,169

2) Expenditures

Cropping Inputs

Fertilizer - Potatoes 5/		$ 8,550
- Grain 6/		2,010
Seed - Potatoes 7/		6,000
- Grain and forage 8/		1,162
Spray materials - Potatoes 9/		1,800
- Grain - custom $2/acre		300
Other - Lime and other inputs		2,250
	Total	$22,072

Labour

Hired men - 2 year-round		$ 6,000
Extra harvest labour A/		1,800
Set-cutting		338
Grading and loading		4,200
	Total	$12,338

1/ 150 acres at 230 cwt. per acre less 10 per cent shrinkage less 10 per cent seconds at $2.06 per cwt.

2/ 150 acres at 21 cwt. per acre at 70¢ per cwt.

3/ 150 acres at 45 bushels per acre at $2.25 per cwt.

4/ 2,000 barrels at 10¢ per barrel.

5/ Same.

6/ 150 acres at 400 pounds of 10-10-10 per acre at $67 per ton.

7/ Same.

8/ Grain, 150 acres at $2.75 per acre; forage, 150 acres at $5.00 per acre.

9/ Same.

A/ 150 acres potatoes at $12.00 per acre. (As suggested by Mr. Lewis)

Machinery and Equipment

	Total same	$ 5,965

Buildings

Depreciation		$ 2,650
Repair		460
Insurance B/		504
	Total	$ 3,614

Other Costs

Custom combining @ $6/acre for 150 acres		$ 900
Taxes 0.8% of land & building investment		904
Interest on seed and fertilizer $ 17,772 @ 7%		1,241
Miscellaneous		1,000
	Total	$ 4,045

Total Expenditure $47,034

Per 75 lb. bag - $1.13

3) Net Income

i Net income of the above enterprise.

Gross income	$67,169
Expenditure	47,034
Net income	20,135
Interest on capital (6%)	8,308
Operator labour income	11,837

ii Net income of same enterprise on the basis of the 10-year average price of $1.86 per cwt.

Gross income	$ 61,589
Expenditure	47,034
Net income	14,555
Interest on capital (6%)	8,308
Operator labour income	6,247

B/ The $154 I consider to be for buildings. Crop storage insurance is an additional $350. (As suggested by Mr. Lewis)

iii It might be noted that a raise of 50¢ above the 10-year average per cwt. would be:

Gross income	$76,579
Expenditure	47,034
Net income	29,545
Interest on capital (6%)	8,308
Operator labour income	21,237

50¢ per cwt. or a 27-per-cent increase above the 10-year average would give the operator an additional $14,990 for his investment. When there is a small increase in price, the operator's income rises very quickly. I might add that there should be a growing-crop risk of 7 to 10 per cent of expenditure.

As prepared by: Edwin K. Lewis 1967